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(54) Title: CYCLIC AMINE PHENYL BETA-3 ADRENERGIC RECEPTOR AGONISTS

(57) Abstract: This invention provides compounds of Formula (I) wherein: R¹, R², R³, R⁴, R⁵, T, T¹, T², and X are as defined
hereinbefore, or a pharmaceutically acceptable salt thereof, which are useful in treating or inhibiting metabolic disorders related to
insulin resistance or hyperglycemia (typically associated with obesity or glucose intolerance), atherosclerosis, gastrointestinal disor-
ders, neurogenetic inflammation, glaucoma, ocular hypertension and frequent urination; and are particularly useful in the treatment
or inhibition of type II diabetes.



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CYCLIC AMINE PHENYL BETA-3 ADRENERGIC RECEPTOR AGONISTS

This invention relates to cyclic amine phenyl β_3 adrenergic receptor agonists useful for the treatment of metabolic disorders related to insulin resistance or hyperglycemia (typically associated with obesity or glucose intolerance), atherosclerosis, gastrointestinal disorders, neurogenetic inflammation, glaucoma, ocular hypertension, and frequent urination; and are particularly useful in the treatment or inhibition of type II diabetes.

The subdivision of β adrenergic receptors (β -AR) into β_1 - and β_2 -AR has led to the development of β_1 - and β_2 - antagonists and/or agonists which have been useful for the treatment of cardiovascular disease and asthma. The recent discovery of "atypical" receptors, later called β_3 -AR, has led to the development of β_3 -AR agonists which may be potentially useful as antiobesity and antidiabetic agents. For recent reviews on β_3 -AR agonists, see: 1. A. D. Strosberg, *Annu. Rev. Pharmacol. Toxicol.* **1997**, 37, 421; 2. A. E. Weber, *Ann. Rep. Med. Chem.* **1998**, 33, 193; 3. C. P. Kordik and A. B. Reitz, *J. Med. Chem.* **1999**, 42, 181; 4. C. Weyer, J. F. Gautier and E. Danforth, *Diabetes and Metabolism*, **1999**, 25, 11.

Compounds that are potent and selective β_3 agonists, may be potentially useful antiobesity agents. Low levels or lack of β_1 and β_2 -agonistic properties will minimize or eliminate the adverse side effects that are associated with β_1 and β_2 agonistic activities, i.e. increased heart rate, and muscle tremor, respectively. Early developments in the β_3 -agonist field are described in European patent 427480, US patents 4396627, 4478849, 4999377, and 5153210. These early patents purport to claim compounds with greater selectivity for the β_3 -AR than for the β_1 - and β_2 -AR's. However, clinical trials in humans with such compounds have not been successful to date.

More recently, potent and selective human β_3 agonists have been described in several patents and published applications: WO 98/32753, WO 97/46556, WO 97/37646, WO 97/15549, WO 97/25311, WO 96/16938, WO 95/29159, European Patents 659737, 801060, 714883, 764640, 827746, and US Patents 5561142, 5705515, 5436257, and 5578620. These compounds were evaluated in Chinese hamster ovary (CHO) cells test procedures which predicts the effects that can be expected in humans. These assays utilize cloned human β_3 receptors, expressed in CHO cells (see refs. Granneman et al., *Mol Pharmacol.*, **1992**, 42, 964; Emorine et al., *Science*, **1989**, 245, 1118; Liggett *Mol. Pharmacol.*, **1992**, 42, 634).

β_3 -Adrenergic agonists also are useful in controlling the frequent urge of urination. It has been known that relaxation of the bladder detrusor is under beta adrenergic control (Li J, Yasay G and Kau S. Beta-adrenoceptor subtypes in the detrusor of guinea-pig urinary bladder. *Pharmacology* 1992; **44**: 13-18). Recently, a number of laboratories have provided experimental evidence in a number of animal species including human (Yamazaki Y, Takeda H, Akahane M, Igawa Y, et al. Species differences in the distribution of the beta-adrenoceptor subtypes in bladder smooth muscle. *Br. J. Pharmacol.* 1998; **124**: 593-599) that activation of the β_3 receptor subtype by norepinephrine is responsible for relaxation of the urinary bladder.

Urge urinary incontinence is characterized by abnormal spontaneous bladder contractions that can be unrelated to bladder urine volume. Urge urinary incontinence is often referred to hyperactive or unstable bladder. Several etiologies exist and fall into two major categories, myogenic and neurogenic. The myogenic bladder is usually associated with detrusor hypertrophy secondary to bladder outlet obstruction, or with chronic urinary tract infection. Neurogenic bladders are associated with an uninhibited micturition reflex. An upper motor neuron disease is usually the underlying cause. In either case, the disease is characterized by abnormal spontaneous contractions that result in an abnormal sense of urinary urgency and involuntary urine loss. At present, the most common therapy for hyperactive bladder includes the use of antimuscarinic agents to block the action of the excitatory neurotransmitter acetylcholine. While effective in neurogenic bladders, their utility in myogenic bladders is questionable. In addition, due to severe dry mouth side-effects associated with antimuscarinic therapy, the patient compliance with these agents is only approximately 30%.

In the bladder, β_3 adrenergic receptor agonists activate adenylyl cyclase and generate cAMP through the G-protein coupled β_3 receptor. The resulting phosphorylation of phospholamban/calcium ATPase enhances uptake of calcium into the sarcoplasmic reticulum. The decrease in intracellular calcium inhibits bladder smooth muscle contractility.

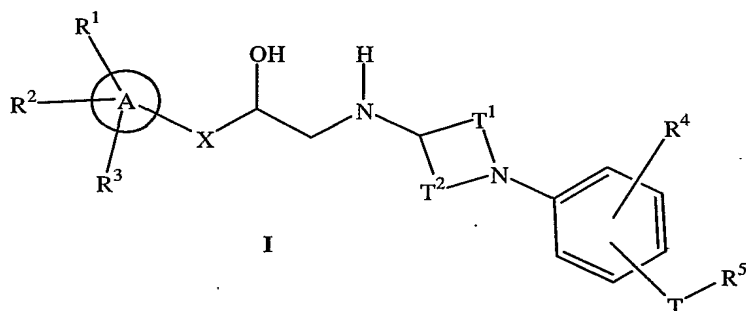
It is suggested therefore, that activation of the β_3 adrenergic receptor in the urinary bladder will inhibit abnormal spontaneous bladder contractions and be useful for the treatment of bladder hyperactivity. Note, that unlike the antimuscarinics, β_3 adrenergic receptor agonists would be expected to be active against both neurogenic and myogenic etiologies.

Despite all these recent developments there is still no single therapy available for the treatment of type II diabetes (NIDDM), obesity, atherosclerosis, gastrointestinal disorders,

neurogenetic inflammation, frequent urination and related diseases. A potent and selective β_3 adrenergic receptor agonist is therefore highly desirable for the potential treatment of such disease states.

5 DESCRIPTION OF THE INVENTION

This invention provides compounds of Formula I having the structure



wherein

A is Ar or Het;

10 X is -OCH₂-, -SCH₂-, or a bond;

T¹ is (CH₂)_m;

T² is (CH₂)_n;

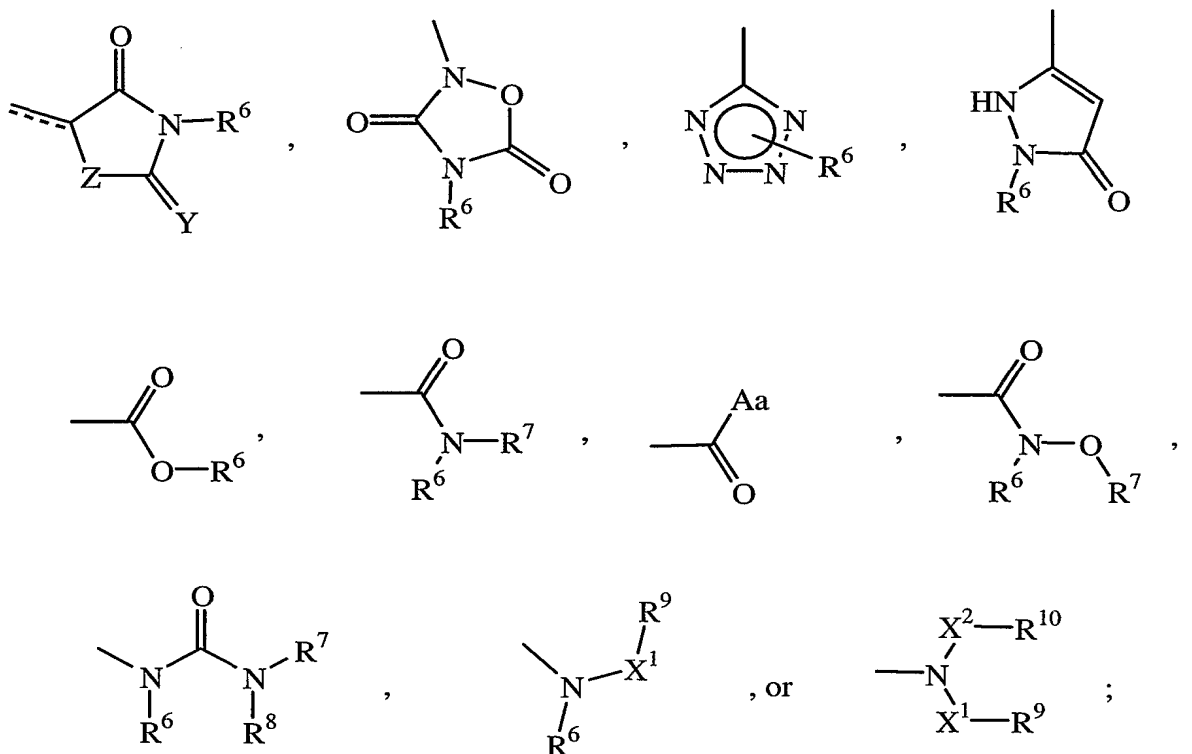
T is a bond, alkyl of 1-6 carbon atoms optionally substituted with R¹¹, alkenyl of 2-7 carbon atoms optionally substituted with R¹¹, alkynyl of 2-7 carbon atoms, alkylthio of 1-6 carbon atoms, alkylamino of 1-6 carbon atoms, alkoxyalkyl of 1-6 carbon atoms per alkyl moiety, alkylthioalkyl of 1-6 carbon atoms per alkyl moiety, alkoxy of 1-6 carbon atoms, alkoxyalkyl of 1-6 carbon atoms per alkyl moiety, alkyloxyalkyl of 1-6 carbon atoms per alkyl moiety, acyl of 2-7 carbon atoms, or alkenylcarbonyl of 3-8 carbon atoms;

20 R¹, R², and R³ are each, independently, hydrogen, alkyl of 1-6 carbon atoms, cycloalkyl of 3-8 carbon atoms, hydroxy, halogen, trifluoromethyl, alkoxy of 1-6 carbon atoms, benzyloxy, allyloxy, propargyloxy, acyloxy of 2-7 carbon atoms, cyano, nitro, amino, aminocarbonyl, alkylamino of 1-6 carbon atoms, dialkylamino of 1-6 carbon atoms per alkyl group, formamido, ureido, acylamino of 2-7 carbon atoms, alkylsulfonylamino of 1-6 carbon atoms, arylsulfonylamino, dialkylphosphorylamino of 1-6 carbon atoms per alkyl group, dihydroxyphosphorylamino, -CO₂-alkyl of 1-6 carbon atoms, or Ar optionally substituted with R¹¹;

25

R^4 is hydrogen, alkyl of 1-6 carbon atoms, halogen, hydroxy, alkoxy of 1-6 carbon atoms, alkylthio of 1-6 carbon atoms, amino, alkylamino of 1-6 carbon atoms, carboxy, acyl of 2-7 carbon atoms, $ArCO-$, alkoxycarbonyl of 2-7 carbon atoms, aminocarbonyl, alkylaminocarbonyl of 2-7 carbon atoms, alkylsulfonyl of 1-6 carbon atoms, or alkylsulfonylamino of 1-6 carbon atoms;

R^5 is



Aa is (i) an amino acid, wherein the nitrogen of amino acid attached to the adjacent carbonyl of R^5 ; or (ii) an alkyl ester of an amino acid, wherein the nitrogen of amino acid attached to the adjacent carbonyl of R^5 , and the alkyl moiety of the alkyl ester contains 1-6 carbon atoms;

Y and Z are each, independently, NR^7 , O, or S;

X^1 and X^2 are each, independently, CO or SO_2 ;

a dotted line represents an optional double bond;

R^6 , R^7 , and R^8 are each, independently, hydrogen; alkyl of 1-6 carbon atoms optionally substituted by R^{11} , R^{12} , and R^{13} ; alkenyl of 2-7 carbon atoms optionally substituted by R^{11} , R^{12} , and R^{13} ; alkynyl of 2-7 carbon atoms optionally substituted with R^{11} ; cycloalkyl of 3-8 carbon atoms optionally substituted by R^{11} , R^{12} , and R^{13} ; bicycloalkyl

of 7-11 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; -CO₂-alkyl of 1-6 carbon atoms; Het optionally substituted by R¹¹, R¹², or R¹³; or Ar optionally substituted by R¹¹, R¹², and R¹³; or when R⁶ and R⁷ are contained on a common nitrogen, they may be taken together to form a saturated 5-7 membered heterocycle that is optionally substituted with R¹¹;

R⁹ and R¹⁰ are each, independently, alkyl optionally substituted by R¹¹, R¹², and R¹³; Ar optionally mono-, di-, or tri-substituted by R¹⁵; Ar fused to a cycloalkyl ring of 3-8 carbon atoms, and optionally mono-, di-, or tri-substituted by R¹⁵; Het optionally mono-, di-, or tri-substituted by R¹⁵;

R¹¹, R¹², or R¹³ are each, independently, alkyl of 1-6 carbon atoms, halogen, alkenyl of 2-7 carbon atoms, alkynyl of 2-7 carbon atoms, cycloalkyl of 3-8 carbon atoms, Ar-alkyl having 1-6 carbon atoms in the alkyl moiety, Ar optionally substituted with R¹⁴, Het optionally substituted with R¹⁴, hydroxy, alkoxy of 1-6 carbon atoms, Ar-oxy, oxo, -CN, -CHO, -CO₂H, -OCO₂-alkyl of 1-6 carbon atoms, -CO₂-alkyl of 1-6 carbon atoms, -CO₂-Ar, -CO₂-alkyl-Ar wherein the alkyl moiety has 1-6 carbon atoms, -OCO₂-Ar, -CONH₂, -CONHOH, amino, alkylamino of 1-6 carbon atoms, dialkylamino of 1-6 carbon atoms per alkyl moiety, -NHCONH-alkyl of 1-6 carbon atoms, -NHSO₂-alkyl of 1-6 carbon atoms, -NHSO₂-Ar, or -NHSO₂-Het; or when R¹¹ and R¹² are contained on a common carbon atom of an alkyl moiety, they may be taken together to form a spiro cycloalkyl ring of 3-8 carbon atoms;

R¹⁴ is halogen, alkoxy of 1-6 carbon atoms, alkyl of 1-6 carbon atoms, alkenyl of 2-7 carbon atoms, alkynyl of 2-7 carbon atoms, hydroxy, acyl of 2-7 carbon atoms, -SO₂-alkyl of 1-6 carbon atoms, -CO₂-alkyl of 1-6 carbon atoms, or alkoxycarbonylalkyl of 3-13 carbon atoms;

R¹⁵ is

(a) hydroxy, halogen, -CN, -NR¹⁶R¹⁶, -OR¹⁶, -SR¹⁶, trifluoromethyl, alkyl of 1-6 carbon atoms, -SO₂R¹⁷, -O-alkyl-CO₂R¹⁷ wherein the alkyl moiety contains 1-6 carbon atoms, -CO₂R¹⁷, -OCOR¹⁷, -NR¹⁶COR¹⁷, -COR¹⁷, -NR¹⁶SO₂R¹⁷, or -NR¹⁶CO₂R¹⁶; or

(b) alkyl of 1-6 carbon atoms mono-, or di-substituted with hydroxy; halogen; -CN; -NR¹⁶NR¹⁶; -OR¹⁶; -SR¹⁶; trifluoromethyl; alkyl of 1-6 carbon atoms;

-SO₂R¹⁷; -CO₂R¹⁷; -OCOR¹⁷; -NR¹⁶COR¹⁷; -COR¹⁷; -NR¹⁶SO₂R¹⁷; -NR¹⁶CO₂R¹⁶; Ar which may be optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen; or Het which may be optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen;

- 5 (c) Het optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen; or
 (d) Ar optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen;

R¹⁶ is hydrogen, alkyl of 1-6 carbon atoms, cycloalkylalkyl of 4-14 carbon atoms, benzyl, Ar or Het, wherein the Ar or Het moieties may be optionally mono-, di-, or tri- substituted with halogen, nitro, alkylamino of 1-6 carbon atoms, dialkylamino of 1-6 carbon atoms per
 10 alkyl moiety, trifluoromethyl, alkyl of 1-6 carbon atoms, alkoxy of 1-6 carbon atoms, alkylthio of 1-6 carbon atoms, -CO₂H, -CO₂alkyl of 1-6 carbon atoms, or -SO₂alkyl of 1-6 carbon atoms;

R¹⁷ is R¹⁶ or -NR¹⁶R¹⁶;

Het is a monocyclic or bicyclic heterocycle of 5-10 ring atoms, having 1-4 heteroatoms selected
 15 from oxygen, nitrogen, and sulfur; wherein the heterocycle may be saturated, unsaturated, or partially unsaturated; and may be optionally fused to a phenyl ring; wherein one or more of the ring carbon atoms of Het may be a carbonyl moiety, where the ring does not contain a double bond in the position corresponding to that carbon atom;

20 Ar is an aromatic ring system containing 1-2 carbocyclic aromatic rings having 6-10 carbon atoms;

m = 1-3;

n = 1-3;

or a pharmaceutically acceptable salt thereof, which are selective agonists at human β₃
 25 adrenergic receptors and are useful in treating or inhibiting metabolic disorders related to insulin resistance or hyperglycemia (typically associated with obesity or glucose intolerance), atherosclerosis, gastrointestinal disorders, neurogenetic inflammation, glaucoma, ocular hypertension, and frequent urination; and are particularly useful in the treatment or inhibition of type II diabetes.

30

Pharmaceutically acceptable salts can be formed from organic and inorganic acids, for example, acetic, propionic, lactic, citric, tartaric, succinic, fumaric, maleic, malonic, mandelic, malic, phthalic, hydrochloric, hydrobromic, phosphoric, nitric, sulfuric, methanesulfonic, naphthalenesulfonic, benzenesulfonic, toluenesulfonic, camphorsulfonic, and similarly known

acceptable acids when a compound of this invention contains a basic moiety. Salts may also be formed from organic and inorganic bases, such as alkali metal salts (for example, sodium, lithium, or potassium), alkaline earth metal salts, ammonium salts, alkylammonium salts containing 1-6 carbon atoms or dialkylammonium salts containing 1-6 carbon atoms in each
5 alkyl group, and trialkylammonium salts containing 1-6 carbon atoms in each alkyl group, when a compound of this invention contains an acidic moiety.

The compounds of the instant invention all contain at least one asymmetric center. Additional asymmetric centers may be present on the molecule depending upon the nature of
10 the various substituents on the molecule. Each such asymmetric center will produce two optical isomers and all such optical isomers, as separated, pure or partially purified optical isomers or racemic mixtures thereof, are included within the scope of the instant invention. Any enantiomer of a compound of the general Formula I may be obtained by stereospecific synthesis using optically pure starting materials of known configuration.

15 The compounds of the present invention may also contain geometric isomers. Thus, the present invention includes all individual isomers and mixtures thereof.

Alkyl, alkenyl, and alkynyl include both straight chain as well as branched moieties.
20 Halogen means bromine, chlorine, fluorine, and iodine. Where a substituent contains one or more moieties which have the same designation, each of the moieties can be the same or different. Ar and the term "aryl" as a group or part of a group means a carbocyclic aromatic ring system of 6-10 carbon atoms such as phenyl and naphthyl. Benzyl is the preferred arylalkyl moiety.

25 X may be for example -OCH₂- or a bond.

T may for example be a bond, alkyl of 1-6 carbon atoms optionally substituted with R¹¹, alkenyl of 2-7 carbon atoms optionally substituted with R¹¹, or alkoxyalkyl of 1-6 carbon atoms
30 per alkyl moiety.

R¹, R², and R³ may be each, independently, hydrogen, alkyl of 1-6 carbon atoms, hydroxy, halogen, trifluoromethyl, alkoxy of 1-6 carbon atoms, benzyloxy, acyloxy of 2-7 carbon atoms, cyano, nitro, amino, aminocarbonyl, alkylamino of 1-6 carbon atoms, dialkylamino of 1-6
35 carbon atoms per alkyl group, acylamino of 2-7 carbon atoms, alkylsulfonylamino of 1-6 carbon

atoms, arylsulfonylamino, -CO₂-alkyl of 1-6 carbon atoms, or Ar optionally substituted with R¹¹.

R⁴ may be hydrogen or halogen.

5

Examples of X¹ are CO or SO₂.

10

R⁶, R⁷, and R⁸ may each be independently, for example, hydrogen; alkyl of 1-6 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; cycloalkyl of 3-8 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; bicycloalkyl of 7-11 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; -CO₂-alkyl of 1-6 carbon atoms; Het optionally substituted by R¹¹, R¹², or R¹³; or Ar optionally substituted by R¹¹, R¹², and R¹³; or when R⁶ and R⁷ are contained on a common nitrogen, they may be taken together to form a saturated 5-7 membered heterocycle that is optionally substituted with R¹¹.

15

R¹⁴ may be halogen, alkoxy of 1-6 carbon atoms, alkyl of 1-6 carbon atoms, hydroxy, acyl of 2-7 carbon atoms, -SO₂-alkyl of 1-6 carbon atoms, -CO₂-alkyl of 1-6 carbon atoms, or alkoxycarbonylalkyl of 3-13 carbon atoms.

20 R¹⁵ may be

(a) halogen, -CN, -OR¹⁶, trifluoromethyl, alkyl of 1-6 carbon atoms, -SO₂R¹⁷, -O-alkyl-CO₂R¹⁷ wherein the alkyl moiety contains 1-6 carbon atoms, -CO₂R¹⁷, -NR¹⁶COR¹⁷, -COR¹⁷; or

25

(b) alkyl of 1-6 carbon atoms mono-, or di-substituted with halogen; -NR¹⁶COR¹⁷; Ar which may be optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen; or Het which may be optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen;

(c) Het optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen; or

(d) Ar optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen.

30

Ar may be for example phenyl.

m may be 1 or 2.

n may be 1 or 2.

Preferred Het moieties include: (a) 6-membered saturated, partially unsaturated, or unsaturated heterocycles containing 1-2 nitrogens, optionally fused to a phenyl ring; (b) 5-membered saturated, partially saturated, or unsaturated heterocycles containing 1-3 nitrogen, oxygen, or sulfur atoms, optionally fused to a phenyl ring; (c) saturated, partially unsaturated, or unsaturated bicyclic heterocycles containing 1-4 nitrogen, oxygen, or sulfur atoms; (d) carbazole, dibenzofuran, and dibenzothiophene. In the Het of categories (a), (b), and (c), ring carbon atoms may be carbonyl moieties, where the ring does not contain a double bond in that position (for example, thiazolidine-2,4-dione).

More preferred Het rings include pyrrole, furan, thiophene, imidazole, pyrazole, furazan, triazole, tetrazole, oxazole, oxadiazole, isoxazole, thiazole, isothiazole, thiadiazole, pyridine, pyrimidine, pyridazine, pyrazine, 1,3,5-triazine, 1,2,4,5-tetrazine, benzofuran, isobenzofuran, indole, isoindole, benzothiophene, benzimidazol, 3H-benzoxazol-2-one, benzotriazole, quinoline, isoquinoline, quinazoline, indazole, 1H-quinolin-2-one, 3,4-dihydro-1H-quinolin-2-one, 2,3-dihydro-1H-indole, 1,3-dihydro-benzoinimidazol-2-thione, carbazole, 3,5-dioxo-[1,2,4]oxadiazolidine, 2,4-dioxo-3-thiazolidine, 1H-benzoimidazole, 2-thioxo-thiazolidin-4-one, 2-imino-4-oxo-thiazolidine, 2-oxo-1,2,3,4-tetrahydro-quinoline, 2,4-dioxo-thiazolidine, 5-oxo-2,5-dihydro-1H-pyrazole, 2-oxo-2,3-dihydro-1H-benzimidazole, 9H-carbazole, benzothiophene, morpholine, piperidine, and 1,3-benzodioxole. It is understood that Het do not contain heteroatoms in arrangements which would make them inherently unstable. For example, the term Het does not include ring systems containing O-O bonds in the ring backbone.

Preferred amino acids include alanine, valine, leucine, isoleucine, proline, phenylalanine, tryptophan, methionine, glycine, serine, threonine, cysteine, tyrosine, asparagine, glutamine, aspartic acid, glutamic acid, lysine, arginine, histidine, β -alanine, cyclopropane amino acids (such as 1-aminocyclopropane-1-carboxylic acid, allo-coronamic acid and 2,3-methanohomoserine), 1-aminocyclohexane-1-carboxylic acid, isonipecotic acid, 2-azetidinedicarboxylic acid, and esters thereof.

Preferred compounds of Formula I are those having one or more (e.g. all) of the following values:

A is Ar or Het;

X is -OCH₂- or a bond;

T¹ is (CH₂)_m;

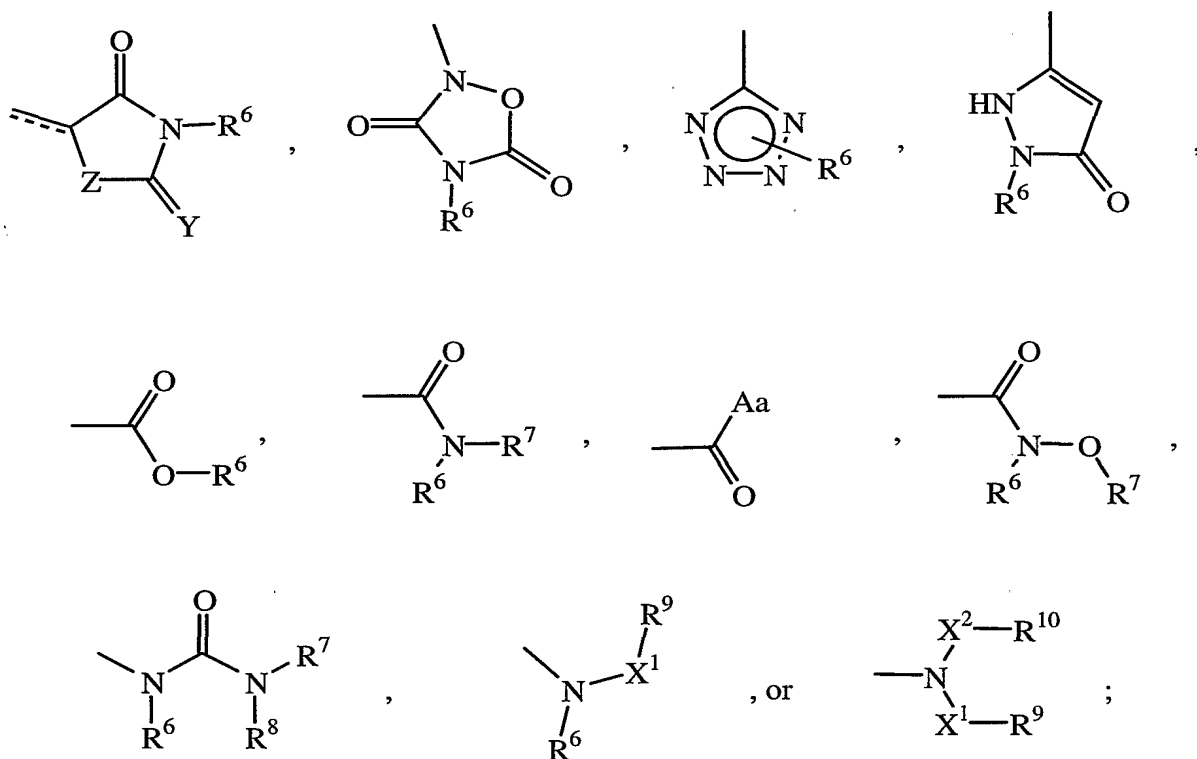
T² is (CH₂)_n;

T is a bond, alkyl of 1-6 carbon atoms optionally substituted with R¹¹, alkenyl of 2-7 carbon atoms optionally substituted with R¹¹, or alkoxyalkyl of 1-6 carbon atoms per alkyl moiety;

- 5 R¹, R², and R³ are each, independently, hydrogen, alkyl of 1-6 carbon atoms, hydroxy, halogen, trifluoromethyl, alkoxy of 1-6 carbon atoms, benzyloxy, acyloxy of 2-7 carbon atoms, cyano, nitro, amino, aminocarbonyl, alkylamino of 1-6 carbon atoms, dialkylamino of 1-6 carbon atoms per alkyl group, acylamino of 2-7 carbon atoms, alkylsulfonylamino of 1-6 carbon atoms, arylsulfonylamino, -CO₂-alkyl of 1-6 carbon atoms, or Ar optionally substituted with R¹¹;
- 10

R⁴ is hydrogen or halogen;

R⁵ is



- 15 Aa is (i) an amino acid, wherein the nitrogen of amino acid attached to the adjacent carbonyl of R⁵; or (ii) an alkyl ester of an amino acid, wherein the nitrogen of amino acid attached to the adjacent carbonyl of R⁵, and the alkyl moiety of the alkyl ester contains 1-6 carbon atoms;

Y and Z are each, independently, NR⁷, O, or S;

X¹ and X² are each, independently, CO or SO₂;

a dotted line represents and optional double bond;

R⁶, R⁷, and R⁸ are each, independently, hydrogen; alkyl of 1-6 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; cycloalkyl of 3-8 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; bicycloalkyl of 7-11 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; -CO₂-alkyl of 1-6 carbon atoms; Het optionally substituted by R¹¹, R¹², or R¹³; or Ar optionally substituted by R¹¹, R¹², and R¹³; or when R⁶ and R⁷ are contained on a common nitrogen, they may be taken together to form a saturated 5-7 membered heterocycle that is optionally substituted with R¹¹;

R⁹ and R¹⁰ are each, independently, alkyl optionally substituted by R¹¹, R¹², and R¹³; Ar optionally mono-, di-, or tri-substituted by R¹⁵; Het optionally mono-, di-, or tri-substituted by R¹⁵;

R¹¹, R¹², or R¹³ are each, independently, alkyl of 1-6 carbon atoms, halogen, alkenyl of 2-7 carbon atoms, alkynyl of 2-7 carbon atoms, cycloalkyl of 3-8 carbon atoms, Ar-alkyl having 1-6 carbon atoms in the alkyl moiety, Ar optionally substituted with R¹⁴, Het optionally substituted with R¹⁴, hydroxy, alkoxy of 1-6 carbon atoms, Ar-oxy, oxo, -CN, -CHO, -CO₂H, -OCO₂-alkyl of 1-6 carbon atoms, -CO₂-alkyl of 1-6 carbon atoms, -CO₂-Ar, -CO₂-alkyl-Ar wherein the alkyl moiety has 1-6 carbon atoms, -OCO₂-Ar, -CONH₂, -CONHOH, amino, alkylamino of 1-6 carbon atoms, dialkylamino of 1-6 carbon atoms per alkyl moiety, -NHCONH-alkyl of 1-6 carbon atoms, -NHSO₂-alkyl of 1-6 carbon atoms, -NHSO₂-Ar, or -NHSO₂-Het; or when R¹¹ and R¹² are contained on a common carbon atom of an alkyl moiety, they may be taken together to form a spiro cycloalkyl ring of 3-8 carbon atoms;

R¹⁴ is halogen, alkoxy of 1-6 carbon atoms, alkyl of 1-6 carbon atoms, hydroxy, acyl of 2-7 carbon atoms, -SO₂-alkyl of 1-6 carbon atoms, -CO₂-alkyl of 1-6 carbon atoms, or alkoxycarbonylalkyl of 3-13 carbon atoms;

R¹⁵ is

(a) halogen, -CN, -OR¹⁶, trifluoromethyl, alkyl of 1-6 carbon atoms, -SO₂R¹⁷, -O-alkyl-CO₂R¹⁷ wherein the alkyl moiety contains 1-6 carbon atoms, -CO₂R¹⁷, -NR¹⁶COR¹⁷, -COR¹⁷; or

(b) alkyl of 1-6 carbon atoms mono-, or di-substituted with halogen; -NR¹⁶COR¹⁷; Ar which may be optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen; or Het which may be optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen;

5 (c) Het optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen; or

(d) Ar optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen;

R¹⁶ is hydrogen, alkyl of 1-6 carbon atoms, cycloalkylalkyl of 4-14 carbon atoms, benzyl, Ar or Het, wherein the Ar or Het moieties may be optionally mono-, di-, or tri- substituted with halogen, nitro, alkylamino of 1-6 carbon atoms, dialkylamino of 1-6 carbon atoms per
10 alkyl moiety, trifluoromethyl, alkyl of 1-6 carbon atoms, alkoxy of 1-6 carbon atoms, alkylthio of 1-6 carbon atoms, -CO₂H, -CO₂alkyl of 1-6 carbon atoms, or -SO₂alkyl of 1-6 carbon atoms;

R¹⁷ is R¹⁶ or -NR¹⁶R¹⁶;

Het is a monocyclic or bicyclic heterocycle of 5-10 ring atoms, having 1-4 heteroatoms selected
15 from oxygen, nitrogen, and sulfur; wherein the heterocycle may be saturated, unsaturated, or partially unsaturated; and may be optionally fused to a phenyl ring;

Ar is an aromatic ring system containing 1-2 carbocyclic aromatic rings having 6-10 carbon atoms;

m = 1-2;

20 n = 1-2;

or a pharmaceutically acceptable salt thereof.

Specifically preferred compounds of this invention are:

- a) N-[5-((1R)-2-{1-[4-(3,5-dioxo-[1,2,4]oxadiazolidin-2-ylmethyl)phenyl]piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide;
25
- b) 5-[[4-[4-[(R)-2-hydroxy-2-[4-hydroxy-3-[(methylsulfonyl)amino]phenyl]ethyl]amino]-1-piperidinyl]phenyl]methyl]-2,4-dioxo-3-thiazolidineacetic acid tert-butyl-ester;
- c) 5-[[4-[4-[(R)-2-hydroxy-2-[4-hydroxy-3-[(methylsulfonyl)amino]phenyl]ethyl]amino]-1-piperidinyl]phenyl]methyl]-2,4-dioxo-3-thiazolidineacetic acid;
- 30 d) 5-[[4-[4-[(R)-2-hydroxy-2-[4-hydroxy-3-[(methylsulfonyl)amino]phenyl]ethyl]amino]-1-piperidinyl]phenyl]methyl]-2,4-dioxo-3-thiazolidineacetic acid ethyl-ester;
- e) 5-(3-fluoro-4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)-propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;

- f) 5-(3-bromo-4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)-propylamino]-piperidin-1-yl}-benzylidene)-thiazolidine-2,4-dione;
- g) 5-(3-fluoro-4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)-propylamino]-piperidin-1-yl}-benzylidene)-thiazolidine-2,4-dione;
- 5 h) N-[5-(2-{1-[2-bromo-4-(2,4-dioxo-thiazolidin-5-ylidenemethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide;
- i) N-[5-(2-{1-[4-(2,4-dioxo-thiazolidin-5-ylidenemethyl)-2-fluoro-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide;
- j) 5-{4-[4-((2S)-2-hydroxy-3-phenoxy-propylamino)-piperidin-1-yl]-benzylidene}-2-thioxo-
10 thiazolidin-4-one;
- k) 5-{4-[4-((2S)-2-hydroxy-3-phenoxy-propylamino)-piperidin-1-yl]-benzyl}-thiazolidin-2,4-dione;
- l) 5-(4-{4-[(2S)-3-(4-benzyloxy-phenoxy)-2-hydroxy-propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;
- 15 m) 5-(4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)-propylamino]-piperidin-1-yl}-benzylidene)-thiazolidine-2,4-dione;
- n) 5-(4-{4-[(2S)-2-hydroxy-3-(4-hydroxy-phenoxy)-propylamino]-piperidin-1-yl}-benzylidene)-thiazolidine-2,4-dione;
- o) N-[5-(2-{1-[4-(2,4-dioxo-thiazolidin-5-ylidenemethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide;
- 20 p) N-[5-(2-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide;
- q) 5-(4-{4-[2-(3-chloro-phenyl)-(2R)-2-hydroxyethylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;
- 25 r) 5-(4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)-propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;
- s) 5-(4-{4-[(2S)-2-hydroxy-3-(4-hydroxy-phenoxy)-propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;
- t) 5-(4-{4-[(2S)-2-hydroxy-3-(4-hydroxy-phenoxy)-propylamino]-piperidin-1-yl}-benzylidene)-
30 2-thioxo-thiazolidin-4-one;
- u) 5-{4-[4-((2S)-2-hydroxy-3-phenoxy-propylamino)-piperidin-1-yl]-benzylidene}-thiazolidine-2,4-dione;
- v) N-[5-((2R)-2-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide;
- 35 w) N-[5-(2-{1-[4-(2,5-dioxo-imidazolidin-4-ylidenemethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide;

- x) 5-(4-{4-[2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)propylamino]piperidin-1-yl}-benzyl)-imidazolidine-2,4-dione-piperidin-1-yl)-benzyl)-imidazolidine-2,4-dione;
- y) N-[5-(2-{1-[4-(2,5-dioxo-imidazolidin-4-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide;
- 5 z) N-[2-hydroxy-5-(1-hydroxy-2-{1-[4-(2-imino-4-oxo-thiazolidin-5-ylidenemethyl)-phenyl]-piperidin-4-ylamino}-ethyl)-phenyl]-methanesulfonamide;
- aa) 4-((2S)-2-hydroxy-3-{1-[4-(2-imino-4-oxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-propoxy)-1,3-dihydro-benzoimidazol-2-one;
- bb) N-[2-hydroxy-5-(1-hydroxy-2-{1-[4-(2-imino-4-oxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-ethyl)-phenyl]-methanesulfonamide;
- 10 cc) 5-(4-{4-[(2S)-2-hydroxy-3-(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-quinolin-5-yloxy)-propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;
- dd) N-[5-((2S)-3-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-2-hydroxy-propoxy)-2-hydroxy-phenyl]-methanesulfonamide;
- 15 ee) N-[5-((2S)-3-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-2-hydroxy-propoxy)-2-hydroxy-phenyl]-benzenesulfonamide;
- ff) (R)-propane-2-sulfonic acid [5-(2-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-amide;
- gg) N-[2-chloro-5-((1R)-2-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)phenyl]piperidin-4-ylamino}-1-hydroxy-ethyl)-phenyl]-methanesulfonamide;
- 20 hh) N-(5-((1R)-2-[(1-{4-[(2,4-dioxo-1,3-thiazolidin-5-yl)methyl]phenyl}piperidin-4-yl)amino]-1-hydroxyethyl)-2-hydroxyphenyl)benzenesulfonamide;
- ii) N-[2-hydroxy-5-(1-hydroxy-2-{1-[4-(1H-tetrazol-5-yl)-phenyl]-piperidin-4-ylamino}-ethyl)-phenyl]-methanesulfonamide;
- 25 jj) ethyl [5-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}phenyl)-1H-tetraazol-1-yl] acetate;
- kk) [5-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl)-1H-tetraazol-1-yl] acetic acid;
- ll) [5-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl)-2H-tetraazol-2-yl]acetic acid;
- 30 mm) 5-{4-[4-((2S)-2-hydroxy-2-[2-(trifluoromethyl)-1,3-thiazol-4-yl]ethyl)amino]piperidine-1-yl}benzyl)-1,3-thiazolidine-2,4-dione;
- nn) 5-{4-[4-((2S)-2-[3-(3,4-dichlorophenyl)isoxazol-5-yl]-2-hydroxyethyl)amino]piperidin-1-yl}benzyl)-1,3-thiazole-2,4-dione;
- 35 oo) N-(4-((1R)-2-[(1-{4-[(2,4-dioxo-1,3-thiazolidin-5-yl)methyl]phenyl}piperidine-4yl)amino]-1-hydroxyethyl))phenyl)methanesulfonamide;

- pp) 5-[4-(4-{[4-(2S)-2-(3-bromoisoxazol-5-yl)-2-hydroxyethyl]amino}piperidine-1-yl)benzyl]-1,3-thiazolidine-2,4-dione;
- qq) 5-(4-{4-[(2S)-2-hydroxy-3-(pyridin-3-yloxy)-propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;
- 5 rr) 5-(4-{4-[(2S)-2-hydroxy-3-(6-methyl-pyridin-3-yloxy)-propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;
- ss) 5-{4-[4-((2S)-2-hydroxy-2-pyridin-3-yl-ethylamino)-piperidin-1-yl]-benzyl}-thiazolidine-2,4-dione;
- tt) 5-(4-{4-[(2S)-2-(6-amino-pyridin-3-yl)-2-hydroxy-ethylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione hydrochloride;
- 10 uu) 5-{4-[4-((2R)-2-hydroxy-2-pyridin-3-yl-ethylamino)-piperidin-1-yl]-benzyl}-thiazolidine-2,4-dione;
- vv) N-[5-(2-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-pyridin-2-yl]-methanesulfonamide;
- 15 ww) 5-(3-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-2-fluoro-phenyl]-piperidin-4-ylamino}-(2S)-2-hydroxy-propoxy)-2-methyl-1H-indole-3-carboxylic acid ethyl ester;
- xx) N-[(2R)-2-hydroxy-5-(1-hydroxy-2-{1-[4-(5-oxo-2,5-dihydro-1H-pyrazol-3-yl)-phenyl]-piperidin-4-ylamino}-ethyl)-phenyl]-methanesulfonamide;
- yy) 4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzimidazol-4-yloxy)-propylamino]-piperidin-1-yl}-benzoic acid ethyl ester;
- 20 zz) {4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoic acid ethyl ester;
- aaa) {4-[(2R)-2-(3-chloro-phenyl)-2-hydroxy-ethylamino]-piperidin-1-yl}-benzoic acid ethyl ester hydrochloride;
- 25 bbb) (4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-phenyl)-acetic acid;
- ccc) 3-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-phenyl)-acrylic acid ethyl ester;
- ddd) 3-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-phenyl)-propionic acid;
- 30 eee) (4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzyloxy)-acetic acid;
- fff) 4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoic acid;
- 35 ggg) 3-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-phenyl)-propionic acid ethyl ester;

- hhh) 2-(4-{4-[2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzylidene)-malonic acid diethyl ester;
- iii) 2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzylidene)-malonic acid monoethyl ester;
- 5 jij) 4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzamide;
- kkk) N-benzyloxy-4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzamide;
- 10 lll) diethyl (2S)-2-[(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-[(methylsulfonyl)amino]phenyl)-ethylamino]-1-piperidinyl}benzoyl)amino]pentanedioate;
- mmm) ethyl 3-[(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)-amino]-1-piperidinyl}benzoyl)amino]propanoate;
- nnn) (2S)-2-[(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)-amino]-1-piperidinyl}benzoyl)amino]pentanedioic acid;
- 15 ooo) N-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino]-1-piperidinyl}benzoyl)-beta-alanine;
- ppp) ethyl [(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)-amino]-1-piperidinyl}benzoyl)amino]acetate;
- qqq) [(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino]-1-piperidinyl}benzoyl)amino]acetic acid;
- 20 rrr) (2S)-2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethyl)-amino]-piperidin-1-yl}-benzoylamino)-4-methyl-pentanoic acid ethyl ester;
- sss) (2S)-2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethyl)-amino]-piperidin-1-yl}-benzoylamino)-4-methyl-pentanoic acid;
- 25 ttt) 1-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoyl)-pyrrolidine-(2S)-2-carboxylic acid methyl ester;
- uuu) 1-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoyl)-pyrrolidine-(2S)-2-carboxylic acid;
- vvv) (2S)-2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethyl)-amino]-piperidin-1-yl}-benzoylamino)-3-methyl-butyric acid ethyl ester;
- 30 www) (2S)-2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethyl)-amino]-piperidin-1-yl}-benzoylamino)-3-methyl-butyric acid;
- xxx) (2S)-2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethyl)-amino]-piperidin-1-yl}-benzoylamino)-3-phenyl-propionic acid methyl ester;
- 35 yyy) (2S)-2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethyl)-amino]-piperidin-1-yl}-benzoylamino)-3-phenyl-propionic acid;

- zzz) methyl 1-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-piperidinyl}benzoyl)amino]cyclopropanecarboxylate;
- aaaa) [butyl-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoyl)-amino]-acetic acid ethyl ester;
- 5 bbbb) methyl [(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethylamino]-1-piperidinyl}benzoyl)amino]acetate;
- cccc) (2S)-2-(4-{4-[2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethylamino]-piperidin-1-yl}-benzoylamino)-4-methyl-pentanoic acid methyl ester;
- 10 dddd) (2E)-3-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethylamino]-piperidin-1-yl}-phenyl)-acrylic acid;
- eeee) 4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethylamino]-1-piperidinyl}-N-[(1S)-1-(hydroxymethyl)-3-methylbutyl]benzamide;
- ffff) 4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethylamino]-sulfonyl)amino]phenyl}ethylamino]-1-piperidinyl}-N-[(3S)-2-ethylamino]-1-piperidinyl}-N-[(3S)-2-oxoazepanyl]benzamide;
- 15 gggg) N-butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethylamino]-1-piperidinyl}-N-(1H-tetraazol-5-ylmethyl)benzamide.
- hhhh) N-{4-[4-(2-hydroxy-2-phenyl-ethylamino)-piperidin-1-yl]-phenyl}-4-methoxybenzenesulfonamide;
- 20 iiiii) N-(4-{4-[2-hydroxy-2-(3-hydroxy-phenyl)-ethylamino]-piperidin-1-yl}-phenyl)-4-methoxy-benzenesulfonamide;
- jjjj) N-[4-(4-{4-[2-hydroxy-2-(3-hydroxyphenyl)-ethylamino]-piperidin-1-yl}-phenyl-sulfamoyl)-phenyl]-acetamide;
- kkkk) N-(4-{4-[4-((2R)-2-hydroxy-2-phenyl-ethylamino)-piperidin-1-yl]-phenylsulfamoyl}-phenyl)-acetamide;
- 25 llll) N-(4-{[4-(4-{[2-hydroxy-2-(4-hydroxyphenyl)ethyl]amino}-1-piperidinyl)anilino]-sulfonyl}phenyl)acetamide;
- mmmm) N-[4-(4-{[(2R)-2-(3-chlorophenyl)-2-hydroxyethyl]amino}-1-piperidinyl)phenyl]-4-methoxybenzenesulfonamide;
- 30 nnnn) N-[4-(4-{[(2R)-2-hydroxy-2-phenylethyl]amino}-1-piperidinyl)phenyl]-4-methoxy-benzenesulfonamide;
- oooo) N-(4-{[4-(4-{[2-hydroxy-3-(4-methoxyphenoxy)propyl]amino}-1-piperidinyl)anilino]-sulfonyl}phenyl)acetamide;
- pppp) N-(4-{[4-(4-{[(2R)-2-(3,4-dihydroxyphenyl)-2-hydroxyethyl]amino}-1-piperidinyl)-anilino]sulfonyl}phenyl)acetamide;
- 35

- qqqq) N-(4-([2-(4-([2-hydroxy-2-(3-hydroxyphenyl)ethyl]amino)-1-piperidiny]anilino)sulfonyl]phenyl)acetamide;
- rrrr) N-(4-([2-(4-([(2R)-2-(3,4-dihydroxyphenyl)-2-hydroxyethyl]amino)-1-piperidiny]anilino)sulfonyl]phenyl)acetamide;
- 5 ssss) N-[4-(4-([(2R)-2-(3,4-dihydroxyphenyl)-2-hydroxyethyl]amino)-1-piperidiny]phenyl)-4-methoxybenzenesulfonamide;
- tttt) N-(4-([4-(4-([2-hydroxy-2-(4-hydroxy-3-methoxyphenyl)ethyl]amino)-1-piperidiny]anilino)sulfonyl]phenyl)acetamide;
- uuuu) N-(4-([4-(4-([2-(2,4-dihydroxyphenyl)-2-hydroxyethyl]amino)-1-piperidiny]anilino)sulfonyl]phenyl)acetamide;
- 10 vvvv) N-(4-([4-(4-([(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-piperidiny]anilino)sulfonyl]phenyl)acetamide;
- www) N-{4-([4-(4-([2-hydroxy-2-(4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino)-1-piperidiny]anilino)sulfonyl]phenyl)acetamide;
- 15 xxxx) 4-([(hexylamino)carbonyl]amino)-N-[4-(4-([2-hydroxy-2-(6-methyl-3-pyridiny]ethyl)amino)-1-piperidiny]phenyl]benzenesulfonamide;
- yyyy) N-(4-([4-(4-([(2S)-2-hydroxy-3-phenoxypropyl]amino)-1-piperidiny]anilino)sulfonyl]phenyl)acetamide;
- zzzz) 5-[2-([1-[4-([4-(acetyl)amino]phenyl)sulfonyl]amino)phenyl]-4-piperidiny]amino)-1-hydroxyethyl]-1H-indole-7-carboxamide;
- 20 aaaaa) N-[4-([4-(4-([(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidiny]anilino)sulfonyl]phenyl)acetamide;
- bbbb) 4-([(hexylamino)carbonyl]amino)-N-{4-[4-([(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidiny]phenyl]benzenesulfonamide;
- 25 ccccc) 4-([(hexylamino)carbonyl]amino)-N-(4-[4-([(2R)-2-hydroxy-2-(4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino)-1-piperidiny]phenyl)benzenesulfonamide;
- dddd) 4-[4-(3-cyclopentylpropyl)-5-oxo-4,5-dihydro-1H-tetraazol-1-yl]-N-{4-[4-([(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidiny]phenyl]benzenesulfonamide;
- 30 eeeee) N-{4-[4-([(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidiny]phenyl}-5-(2-pyridiny]-2-thiophenesulfonamide;
- ffff) N-[4-(4-([(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-piperidiny]phenyl)-3,4-dimethoxybenzenesulfonamide;
- 35 ggggg) N-(4-[4-([2-hydroxy-2-(4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino]-1-piperidiny]phenyl)-3,4-dimethoxybenzenesulfonamide;

- hhhhh) 4-butoxy-N-(4-[4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl]phenyl)benzenesulfonamide;
- iiii) N-(4-{[4-(4-[(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino)-1-piperidinyl]-anilino)sulfonyl]phenyl)acetamide;
- 5 jjjjj) 5-chloro-N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)-oxy]propyl]amino)-1-piperidinyl]phenyl}-3-methyl-1-benzothiophene-2-sulfonamide;
- kkkkk) 4-cyano-N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)-oxy]propyl]amino)-1-piperidinyl]phenyl}benzenesulfonamide;
- 10 llll) 4-cyano-N-[(4-cyanophenyl)sulfonyl]-N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]phenyl}benzenesulfonamide;
- mmmmm) 3-bromo-5-chloro-N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]phenyl}-2-thiophenesulfonamide;
- 15 nnnnn) N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]-amino)-1-piperidinyl]phenyl}-5-(3-isoxazolyl)-2-thiophenesulfonamide;
- ooooo) 4-[4-(3-cyclopentylpropyl)-5-oxo-4,5-dihydro-1H-tetraazol-1-yl]-N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}-phenyl)benzenesulfonamide;
- 20 ppppp) 4-butoxy-N-[4-(4-[(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino)-1-piperidinyl]phenyl]benzenesulfonamide;
- qqqqq) N-[4-(4-{[3-(9H-carbazol-4-yloxy)-(2S)-2-hydroxypropyl]amino)-1-piperidinyl]-phenyl)-4-[(hexylamino)carbonyl]amino]benzenesulfonamide;
- rrrrr) N-{4-[(4-[4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl]anilino)sulfonyl]phenyl}acetamide;
- 25 sssss) N-[4-(4-[(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino)-1-piperidinyl]-phenyl]-3,4-dimethoxybenzenesulfonamide;
- ttttt) N-[4-(4-[(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-piperidinyl]phenyl]-5-(2-pyridinyl)-2-thiophenesulfonamide;
- 30 uuuuu) N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl]phenyl)-5-(2-pyridinyl)-2-thiophenesulfonamide;
- vvvvv) N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl]phenyl)-1-butanesulfonamide;
- wwwww) N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]-amino)-1-piperidinyl]phenyl}-1-butanesulfonamide;
- 35

	xxxxx)	N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl)-1-octanesulfonamide;
	yyyyy)	N-{4-[4-({(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino]-1-piperidinyl}phenyl)-1-octanesulfonamide;
5	zzzzz)	N-{4-[4-({(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino]-1-piperidinyl}phenyl}-5-{[5-(trifluoromethyl)-2-pyridinyl]sulfonyl}-2-thiophenesulfonamide;
	aaaaaa)	N-[4-(4-[(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-piperidinyl]-phenyl]-5-{[5-(trifluoromethyl)-2-pyridinyl]sulfonyl}-2-thiophenesulfonamide;
10	bbbbbb)	4-[(2,4-dioxo-1,3-thiazolidin-5-yl)methyl]-N-{4-[4-({(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl}phenyl}benzenesulfonamide;
	cccccc)	4-[(2,4-dioxo-1,3-thiazolidin-5-yl)methyl]-N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl)benzenesulfonamide;
15	dddddd)	N-{4-[4-({(2S)-2-hydroxy-3-[(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-5-quinolinyloxy]propyl)amino)-1-piperidinyl}phenyl]-3,4-dimethoxybenzenesulfonamide;
	eeeeee)	N-[4-(4-[(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-piperidinyl]-phenyl]-1-octanesulfonamide;
20	ffffff)	4-[(hexylamino)carbonyl]amino)-N-{4-[4-({(2S)-2-hydroxy-3-[(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-5-quinolinyloxy]propyl)amino)-1-piperidinyl}phenyl}benzenesulfonamide;
	gggggg)	N-{4-[4-({(2S)-2-hydroxy-3-[(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-5-quinolinyloxy]propyl)amino)-1-piperidinyl}phenyl]-1-butanesulfonamide;
25	hhhhhh)	N-[4-({4-[4-({(2S)-2-hydroxy-3-[(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-5-quinolinyloxy]propyl)amino)-1-piperidinyl]anilino)sulfonyl}phenyl]acetamide;
	iiiiii)	N-(4-{4-[(2S)-2-hydroxy-3-(4-hydroxy-3-[(methylsulfonyl)amino]phenoxy)-propyl]amino)-1-piperidinyl}phenyl)-4-dimethoxybenzenesulfonamide;
	jjjjjj)	N-(4-{4-[(2S)-2-hydroxy-3-(4-hydroxy-3-[(methylsulfonyl)amino]phenoxy)-propyl]amino)-1-piperidinyl}phenyl)-1-butanesulfonamide;
30	kkkkkk)	4-[(hexylamino)carbonyl]amino)-N-(4-{4-[(2S)-2-hydroxy-3-(4-hydroxy-3-[(methylsulfonyl)amino]phenoxy)propyl]amino)-1-piperidinyl}phenyl)benzenesulfonamide;
	llllll)	N-[4-(4-[(2R)-2-(3-chlorophenyl)-2-hydroxyethyl]amino)-1-piperidinyl]phenyl]-4-[(hexylamino)carbonyl]amino)benzenesulfonamide;
35		

	mmmmmm)	ethyl {4-[(4-{4-[(2S)-2-hydroxy-3-{4-hydroxy-3-[(methylsulfonyl)amino]phenoxy}-propyl)amino]-1-piperidinyl}anilino)sulfonyl]phenyl}acetate;
	nnnnnn)	methyl {4-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}anilino)sulfonyl]phenoxy}acetate;
5	oooooo)	methyl [4-({4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)-oxy]propyl]amino)-1-piperidinyl}anilino)sulfonyl]phenoxy}acetate;
	pppppp)	N-[5-({(2S)-3-[(1-{4-[(butylsulfonyl)amino]phenyl}-4-piperidinyl)amino]-2-hydroxypropyl}oxy)-2-hydroxyphenyl]benzenesulfonamide;
	qqqqqq)	N-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(isopropylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}phenyl)-1-butanefulfonamide;
10	rrrrrr)	4-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}anilino)sulfonyl]benzoic acid;
	ssssss)	ethyl 4-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}anilino)sulfonyl]benzoate;
15	tttttt)	methyl {4-[(4-{4-[(2R)-2-{4-chloro-3-[(methylsulfonyl)amino]phenyl}-2-hydroxyethyl)amino]-1-piperidinyl}anilino)sulfonyl]phenoxy}acetate;
	uuuuuu)	methyl 3-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}anilino)sulfonyl]-2-thiophenecarboxylate;
	vvvvvv)	3-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}anilino)sulfonyl]-2-thiophenecarboxylic acid;
20	wwwwww)	benzyl [(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}anilino)sulfonyl]acetate;
	xxxxxx)	[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}anilino)sulfonyl]acetic acid;
25	yyyyyy)	benzyl [(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)sulfonyl]acetate;
	zzzzzz)	[(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}anilino)sulfonyl]acetic acid;
	aaaaaaa)	N-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}phenyl)-3-pyridinesulfonamide;
30	bbbbbbb)	3,4-dichloro-N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]phenyl}benzenesulfonamide;
	ccccccc)	N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl]amino)-1-piperidinyl]phenyl}-4-(trifluoromethyl)benzenesulfonamide;
35	ddddddd)	N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl]amino)-1-piperidinyl]phenyl}-4-(trifluoromethoxy)benzenesulfonamide;

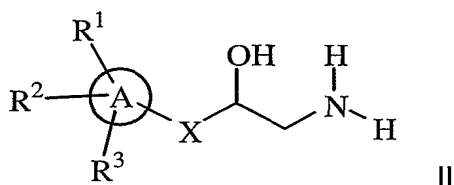
	eeeeeeee)	N-{4-[4-(((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl)amino)-1-piperidinyl]phenyl}-4-methoxybenzenesulfonamide;
	ffffff)	4-chloro-N-{4-[4-(((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}benzenesulfonamide;
5	ggggggg)	4-butyl-N-{4-[4-(((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}benzenesulfonamide;
	hhhhhhh)	3,5-dichloro-N-{4-[4-(((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}benzenesulfonamide;
	iiiiiii)	N-{4-[4-(((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl)amino)-1-piperidinyl]phenyl}-2,5-dimethoxybenzenesulfonamide;
10	jijijij)	N-(4-{4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)-ethyl)amino}-1-piperidinyl)phenyl}-2,5-dimethoxybenzenesulfonamide;
	kkkkkkkk)	ethyl {[4-(4-butylphenyl)sulfonyl]-4-[4-(((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]anilino}acetate;
15	lllllll)	5-bromo-N-[(5-bromo-2-methoxyphenyl)sulfonyl]-N-{4-[4-(((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]-phenyl}-2-methoxybenzenesulfonamide;
	mmmmmmm)	5-bromo-N-{4-[4-(((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}-2-methoxybenzenesulfonamide;
20	nnnnnnn)	ethyl [(3,4-dimethoxyphenyl)sulfonyl]-4-[4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino]-1-piperidinyl]anilino}acetate;
	oooooooo)	ethyl 5-[(2S)-3-{1-(4-[(3,4-dimethoxyphenyl)sulfonyl]amino)phenyl}-4-piperidinyl]amino}-2-hydroxypropyl)oxy]-2-methyl-1H-indole-3-carboxylate;
	ppppppp)	ethyl 4-[(2S)-3-{1-(4-[(3,4-dimethoxyphenyl)sulfonyl]amino)phenyl}-4-piperidinyl]amino}-2-hydroxypropyl)oxy]-2-methyl-5-phenyl-1H-pyrrole-3-carboxylate;
25	qqqqqqq)	benzyl ((butylsulfonyl)-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino]-1-piperidinyl}anilino)acetate;
	rrrrrrr)	((butylsulfonyl)-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino]-1-piperidinyl}anilino)acetic acid;
30	sssssss)	[(3,4-dimethoxyphenyl)sulfonyl]-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino]-1-piperidinyl}anilino)acetic acid;
	ttttttt)	ethyl ((butylsulfonyl)-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino]-1-piperidinyl}anilino)acetate;
35	uuuuuuu)	4-[[3-chloro-5-(trifluoromethyl)-2-pyridinyl]oxy]-N-[4-(4-[(2S)-2-hydroxy-3-phenoxypropyl]amino)-1-piperidinyl]phenyl]benzenesulfonamide;

	vvvvvvv)	N-[[5-([4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)-oxy]propyl)amino)-1-piperidinyl]anilino)sulfonyl]-2-thienyl)methyl]benzamide;
	wwwwwww)	N-[[5-([4-[4-((2S)-2-hydroxy-3-phenoxypropyl)amino)-1-piperidinyl]anilino)sulfonyl]-2-thienyl)methyl]benzamide;
5	xxxxxxx)	N-[[5-([4-[4-([2-hydroxy-2-(3-hydroxyphenyl)ethyl]amino)-1-piperidinyl]anilino)sulfonyl]-2-thienyl)methyl]benzamide;
	yyyyyyy)	4-[[3-chloro-5-(trifluoromethyl)-2-pyridinyl]oxy]-N-[4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl]benzenesulfonamide;
10	zzzzzzzz)	4-[[3-chloro-5-(trifluoromethyl)-2-pyridinyl]oxy]-N-[4-[4-([2-hydroxy-2-(3-hydroxyphenyl)ethyl]amino)-1-piperidinyl]phenyl]benzenesulfonamide;
	aaaaaaaa)	3,5-dichloro-4-(2-chloro-4-nitrophenoxy)-N-[4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl]benzenesulfonamide;
15	bbbbbbbbb)	3,5-dichloro-4-(2-chloro-4-nitrophenoxy)-N-[4-[4-((2S)-2-hydroxy-3-phenoxypropyl)amino)-1-piperidinyl]phenyl]benzenesulfonamide;
	cccccccc)	3,5-dichloro-4-(2-chloro-4-nitrophenoxy)-N-[4-[4-([2-hydroxy-2-(3-hydroxyphenyl)ethyl]amino)-1-piperidinyl]phenyl]benzenesulfonamide;
	dddddddd)	N-[4-[4-((2S)-2-hydroxy-3-phenoxypropyl)amino)-1-piperidinyl]phenyl]-2-thiophenesulfonamide;
20	eeeeeeee)	4-butoxy-N-[4-[4-((2S)-2-hydroxy-3-phenoxypropyl)amino)-1-piperidinyl]phenyl]benzenesulfonamide;
	ffffffff)	N-[4-[4-([2-hydroxy-2-(3-hydroxyphenyl)ethyl]amino)-1-piperidinyl]phenyl]-2-thiophenesulfonamide;
25	ggggggggg)	4-butoxy-N-[4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl]benzenesulfonamide;
	hhhhhhhhh)	N-[4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl]-3,4-dimethoxybenzenesulfonamide;
	iiiiiii)	N-[4-[4-((2S)-2-hydroxy-3-phenoxypropyl)amino)-1-piperidinyl]phenyl]-3,4-dimethoxybenzenesulfonamide;
30	jjjjjjjj)	N-[4-[4-([2-hydroxy-2-(3-hydroxyphenyl)ethyl]amino)-1-piperidinyl]phenyl]-3,4-dimethoxybenzenesulfonamide;
	kkkkkkkkk)	N-[4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl]-2-thiophenesulfonamide;
35	lllllll)	ethyl 3-(4-[4-((2R)-2-hydroxy-2-[4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl]amino)-1-piperidinyl]anilino)-3-oxopropanoate;

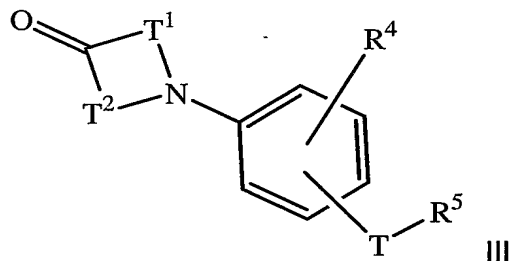
	mmmmmmmm)	3-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}anilino)-3-oxopropanoic acid;
	nnnnnnnn)	ethyl 3-(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)-3-oxopropanoate;
5	oooooooo)	3-(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)-3-oxopropanoic acid;
	pppppppp)	ethyl 3-(cyclohexyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)-3-oxopropanoate;
	qqqqqqqq)	3-(cyclohexyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)-3-oxopropanoic acid;
10	rrrrrrrr)	ethyl {[4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}anilino)carbonyl]amino}acetate;
	ssssssss)	{[4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}anilino)carbonyl]amino}acetic acid;
15	tttttttt)	ethyl {[4-(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)carbonyl]amino}acetate;
	uuuuuuuu)	{[4-(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}anilino)carbonyl]amino}acetic acid;
	vvvvvvvv)	N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino]-1-piperidinyl}phenyl}-3,4-dimethoxybenzamide;
20	wwwwwwww)	2-chloro-N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino]-1-piperidinyl}phenyl}acetamide;
	xxxxxxx)	N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino]-1-piperidinyl}phenyl}-2-(4-morpholinyl)acetamide;
25	yyyyyyyy)	2-(dimethylamino)-N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino]-1-piperidinyl}phenyl}acetamide;
	zzzzzzzz)	N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}phenyl)-3,4-dimethoxybenzamide;
	aaaaaaaa)	N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino]-1-piperidinyl}phenyl}butanamide;
30	bbbbbbbbb)	N-[4-(4-[(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino)-1-piperidinyl]phenyl]butanamide;
	cccccccc)	N-[4-(4-[(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-piperidinyl]phenyl]-3,4-dimethoxybenzamide;
35	ddddddddd)	N-[4-(4-[(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino)-1-piperidinyl]phenyl]-3,4-dimethoxybenzamide;

- eeeeeeee) N-{4-[4-(((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl)amino)-1-piperidinyl]phenyl}-1,3-benzodioxole-5-carboxamide;
- ffffff) N-[4-(4-(((2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl)amino)-1-piperidinyl)-phenyl]-1,3-benzodioxole-5-carboxamide;
- 5 gggggggg) 3-cyclopentyl-N-{4-[4-(((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}propanamide;
- hhhhhhhh) 3-cyclopentyl-N-(4-{4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)-amino]phenyl}ethyl)amino)-1-piperidinyl}phenyl)propanamide;
- iiiiiii) N-(4-{4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino)-1-piperidinyl}phenyl)-1,3-benzodioxole-5-carboxamide;
- 10 jjjjjjj) N-acetyl-N-[4-(3-(((2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl)amino)-1-azetidiny]phenyl]acetamide;
- kkkkkkkk) 4-butoxy-N-[4-(3-(((2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl)amino)-1-azetidiny]phenyl]benzenesulfonamide;
- 15 lllllll) N-[4-(3-(((2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl)amino)-1-azetidiny]-phenyl]-3,4-dimethoxybenzenesulfonamide;
- mmmmmmmm) N-(4-[[4-(3-(((2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl)amino)-1-azetidiny]anilino]sulfonyl]phenyl)acetamide;
- nnnnnnnn) 4-butoxy-N-[4-(3-(((2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl)amino)-1-azetidiny]phenyl]benzenesulfonamide;
- 20 ooooooooo) N-[4-(3-(((2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl)amino)-1-azetidiny]-phenyl]acetamide;
- pppppppp) N-[4-(3-(((2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl)amino)-1-azetidiny]-phenyl]-3,4-dimethoxybenzenesulfonamide;
- 25 qqqqqqqq) N-(4-[[4-(3-(((2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl)amino)-1-azetidiny]anilino]sulfonyl]phenyl)acetamide
- or a pharmaceutically acceptable salt thereof.

- This invention also provides processes for preparing compounds of formula I or
- 30 pharmaceutically acceptable salts thereof, which processes comprise one of the following:
- a) reductively aminating a compound of formula II



wherein R_1 , R_2 , R_3 , X and A are as defined in Claim 1; with a compound of formula III



wherein T, T^1 , T^2 , R^4 and R^5 are as defined in Claim 1 to give a compound of formula I;

- 5 or
- b) removing any protecting groups from a compound of formula I in which at least one substituent carries a protecting group to give a compound of formula I;
- or
- c) converting a basic compound of formula I to a salt thereof by reaction with a
- 10 pharmaceutically acceptable acid;
- or
- d) converting a compound of formula I having one or more reactive substituent groups to a different compound of formula I;
- or
- 15 e) isolating an isomer of a compound of formula I from a mixture thereof.

Conveniently, the compounds of this invention may be prepared according to the following schemes from commercially available starting materials or starting materials which can be prepared using literature procedures. These schemes show the preparation of

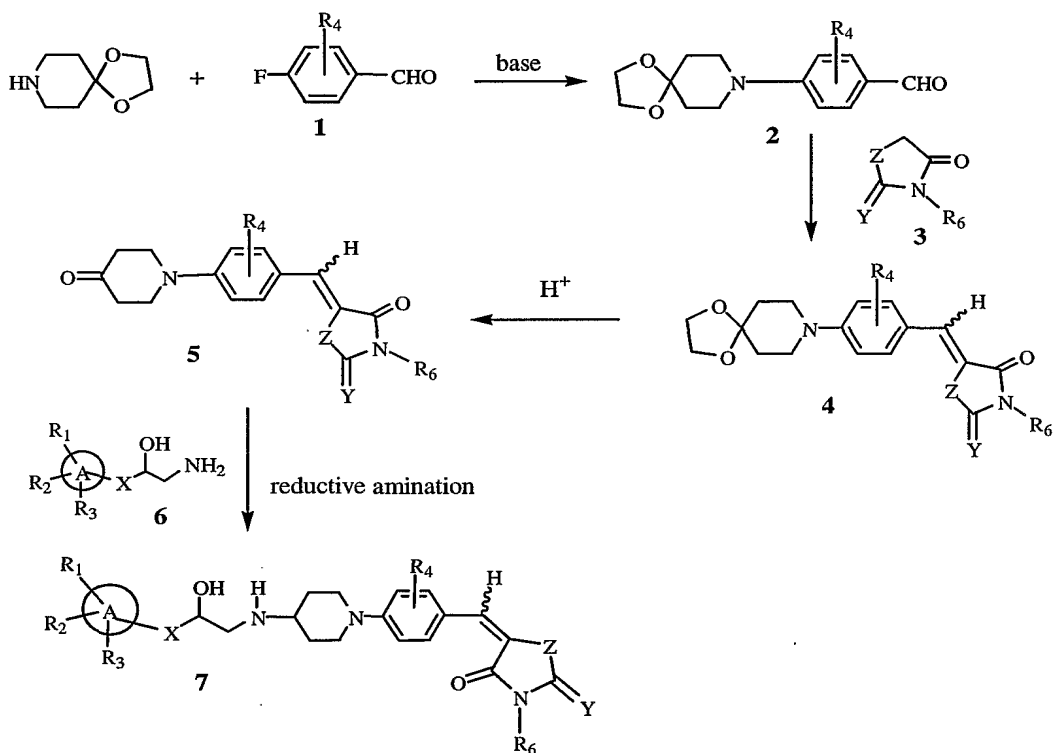
20 representative compounds of this invention.

According to one route (Scheme 1), 1,4-dioxo-8-azaspiro[4.5]decane is reacted with 4-fluorobenzaldehyde **1** in the presence of base such as pyridine or potassium carbonate to afford aldehyde **2**. This reaction can be carried out in a polar solvent such as anhydrous acetonitrile, acetone, N,N-dimethylformamide, or pyridine. Compound **4** is obtained via a

25 Knoevenagel condensation between an appropriate cyclic lactam **3** and the aldehyde **2**. In this reaction sodium acetate, β -alanine, glycine, pyridine, piperidine, pyrrolidine, sodium methoxide, potassium acetate, sodium carbonate and the like can be used as a base, and an alcohol such as methanol, ethanol, isopropanol, methoxyethanol and the like, N,N-dimethylformamide, water, acetic acid and the like can be used as a solvent. Ketal hydrolysis is accomplished in

30 the presence of strong acid such as concentrated hydrochloric acid or 10-30% sulfuric acid. The desired final product **7**, wherein A, R_1 , R_2 , R_3 , R_4 , R_6 , X, Y and Z are as defined above,

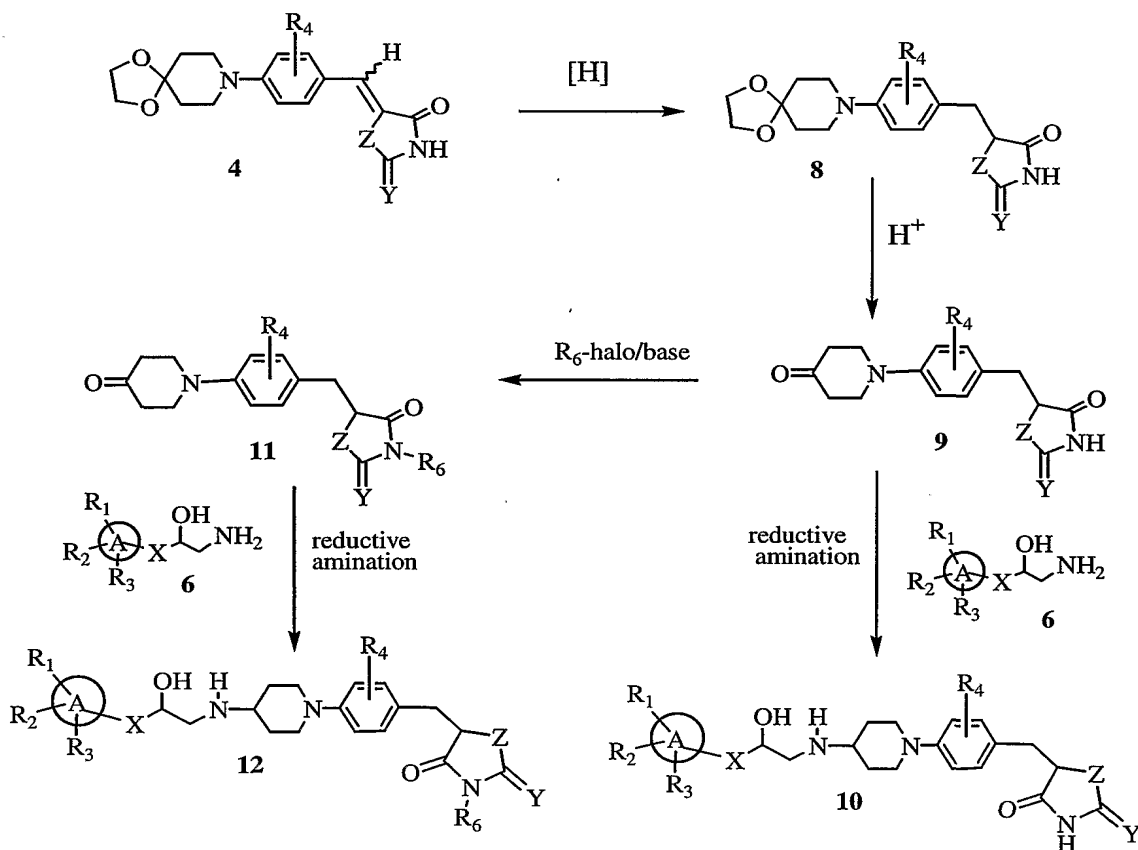
is prepared by utilizing reductive amination of piperidone **5** with appropriate aryloethanolamines or aryloxypropanolamines **6**, many of which are commercially available or can be readily prepared as described in Scheme 19 and Scheme 20. The reductive amination can be carried out, for example, with hydrogen and catalytic palladium, or with sodium borohydride, sodium triacetoxyborohydride and the like in a polar solvent such as methanol, N,N-dimethylformamide and the like. The final products can be purified by recrystallization, trituration, preparative thin layer chromatography, flash column chromatography on silica gel, or high performance liquid chromatography. Purification of intermediates can be achieved in the same manner. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid.

Scheme 1

In some cases the C-C double bond of compound **4** can be reduced (Scheme 2) by catalytic hydrogenation in the presence of a metal catalyst such as palladium, platinum, rhodium and the like. An alcohol such as methanol, ethanol, isopropanol and the like, acetic acid, tetrahydrofuran (THF), dioxane and the like can be used as a solvent in the hydrogenation. In other cases, owing to the presence of sulfur in the molecule, the C-C double bond of compound **4** can not be reduced by ordinary catalytic hydrogenation. However, the reduction can be achieved by a hydrogen transfer reaction using 3-10% sodium mercury amalgam, zinc, dihydropyridine, tin and the like as a hydrogen donor. In this reaction

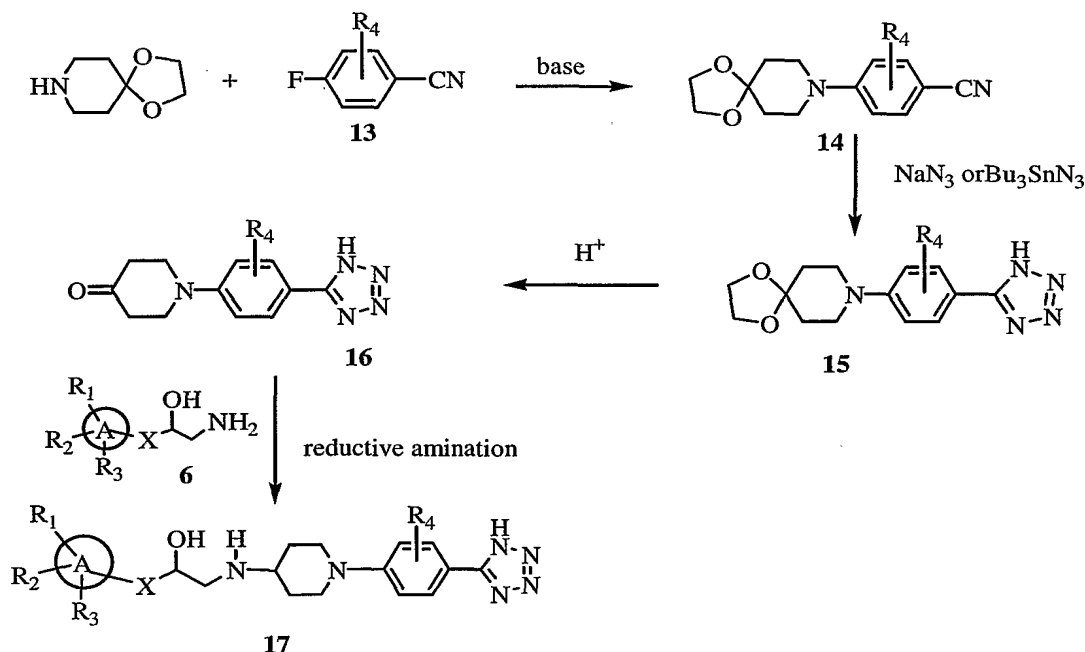
THF/water, acetic acid, toluene, ethanolic hydrogen iodide and the like can be used as a solvent. Ketal hydrolysis under acidic conditions followed by reductive amination, as previously described in Scheme 1, furnishes the desired final product **10**, wherein A, R₁, R₂, R₃, R₄, X, Y and Z are as defined above (Scheme 2). A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid.

Compound **9** could be optionally alkylated with an appropriate alkylating agents R₆-halo in the presence of base to give the alkylated compound **11** (Scheme 2). At this time, bases to be used include cesium carbonate, potassium carbonate, sodium carbonate, sodium acetate, potassium acetate and the like. Solvents used include N,N-dimethylformamide, acetone, acetonitrile and the like. A reductive amination between ketone **11** and amine **6**, as previously described in Scheme 1, furnishes the final product **12**, wherein A, R₁, R₂, R₃, R₄, R₆, X, Y and Z are as defined above. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid.

Scheme 2

The compound represented by the above formula I wherein R₅ is tetrazole can be prepared by one of the following synthetic schemes (Scheme 3 & Scheme 4). Nitrile compound **14** can be obtained by condensing 1,4-dioxa-8-azaspiro[4.5]decane with 4-fluorobenzonitrile as previously described in Scheme 1. The reaction for the formation of the tetrazoles can be carried out by reacting nitriles **14** with sodium azide, tributyltin azide and the like in the presence of an amine salt such as ammonium chloride, triethylamine hydrochloride, diethylamine hydrochloride, tripropylamine hydrosulfate and the like. Solvents used in this reaction include aromatic hydrocarbons such as toluene, xylene, benzene, nitrobenzene and the like. Sometimes the cycloaddition can also be performed in a polar solvent such as N,N-dimethylformamide, dimethylsulfoxide and the like. Ketal hydrolysis under acidic conditions followed by reductive amination, as previously described in Scheme 1, furnishes the final product **17** (Scheme 3), wherein A, R₁, R₂, R₃, R₄ and X are as defined above. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid.

Scheme 3

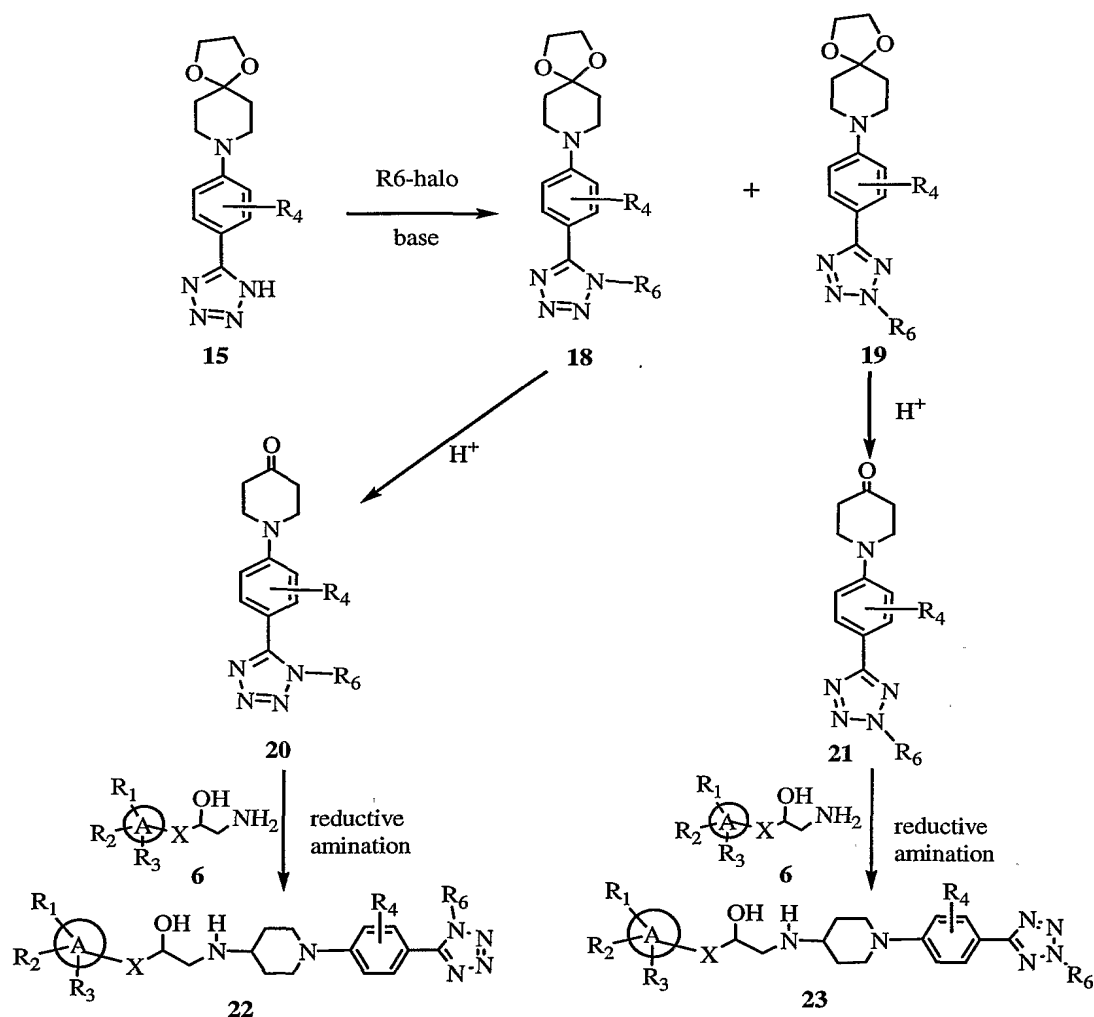


Tetrazole **15** could be optionally alkylated with an appropriate alkylating agents R₆-halo in the presence of base such as cesium carbonate to give a pair of isomers (**18** & **19**) which could be separated by flash column chromatography on silica gel. Ketal hydrolysis under acidic conditions followed by reductive amination, as previously described in Scheme 1,

furnishes the final products **22** or **23**, wherein A, R₁, R₂, R₃, R₄, R₆ and X are as defined above. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid.

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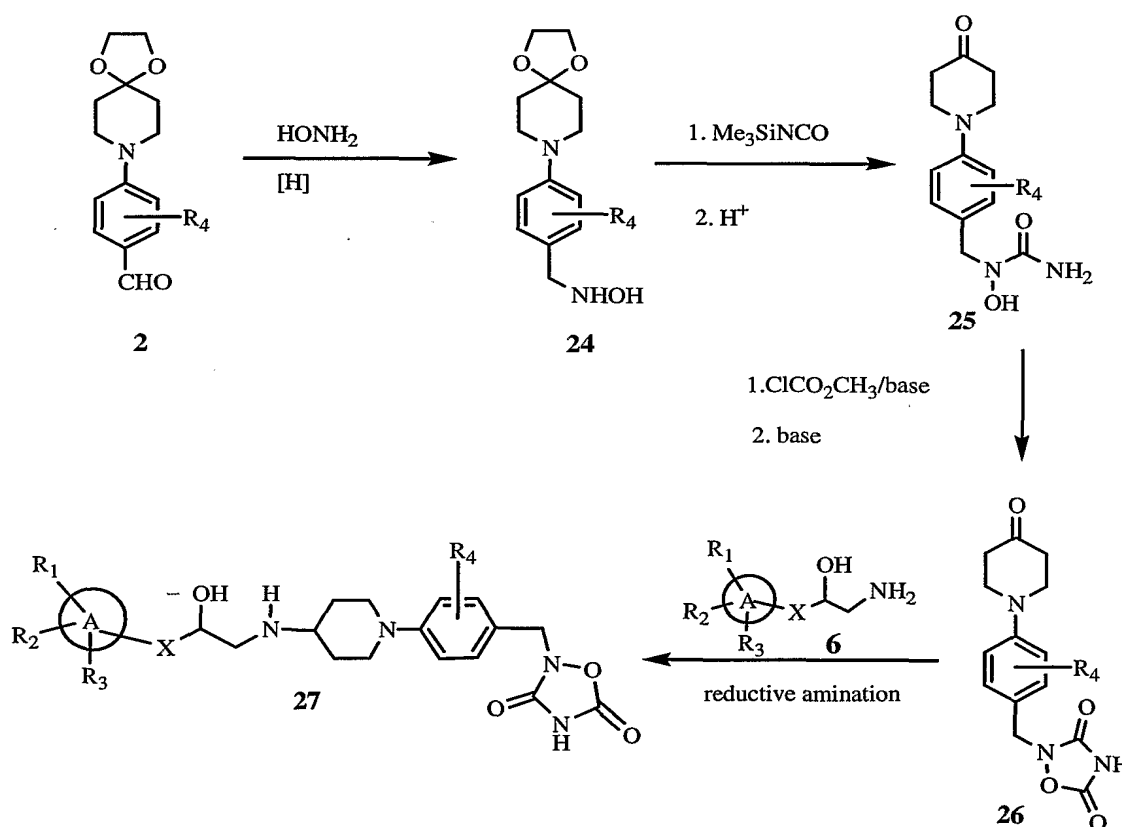
Scheme 4



The compound represented by the above formula I wherein R₅ is oxadiazolidine can be prepared by the following synthetic scheme (Scheme 5). Compound **24** is obtained by a reductive amination reaction between aldehyde **2** and hydroxylamine. This reductive amination can be carried out essentially under the same conditions as that previously described in Scheme 1. N-Hydroxyurea **25** is obtained by reacting compound **24** with isocyanate such as chlorocarbonyl isocyanate, trimethylsilyl isocyanate and the like, followed by ketal hydrolysis. In the isocyanate reaction a polar solvent such as 1,4-dioxane, tetrahydrofuran, N,N-dimethylformamide, dimethylsulfoxide and the like can be used as a solvent. Ketal hydrolysis

is conveniently conducted under acidic conditions as that previously described in Scheme 1. The oxadiazolidine ring is formed by reacting the N-hydroxyurea **25** with chloroformate such as methyl chloroformate, ethyl chloroformate, isobutyl chloroformate and the like in the presence of strong base such as sodium hydride, potassium hydroxide and the like. The final product **27**, wherein A, R₁, R₂, R₃, R₄ and X are as defined above, is obtained by reductive amination between ketone **26** and amine **6** using basically the same conditions as previously described in Scheme 1. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid.

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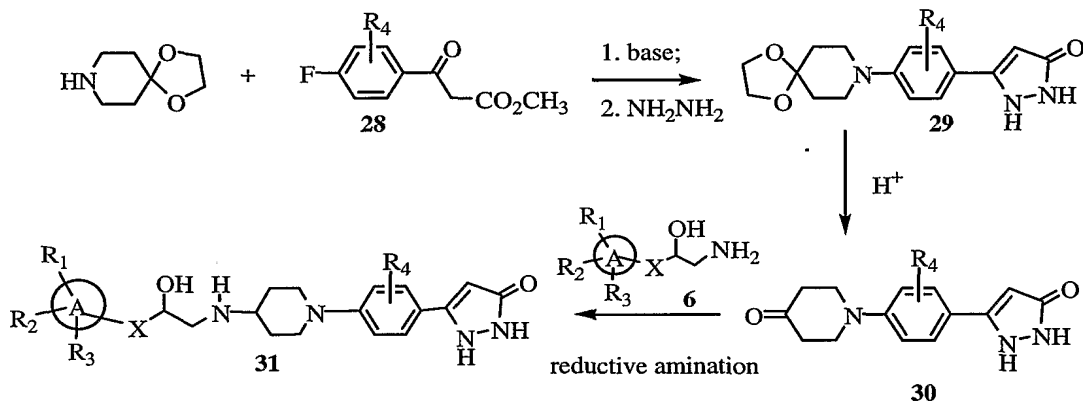
Scheme 5

The compound represented by the above formula I wherein R₅ is pyrazole can be prepared by the following synthetic scheme (Scheme 6). Pyrazole compound **29** can be obtained by condensing 1,4-dioxo-8-azaspiro[4.5]decane with 4-fluorobenzonate **28** as previously described in Scheme 1, followed by pyrazole ring formation which can be carried out by reacting with hydrazine. Solvents used in this ring formation include methanol, ethanol, tetrahydrofuran and the like. Ketal hydrolysis under acidic conditions followed by reductive amination, as previously described in Scheme 1, furnishes the final product **31**, wherein A, R₁,

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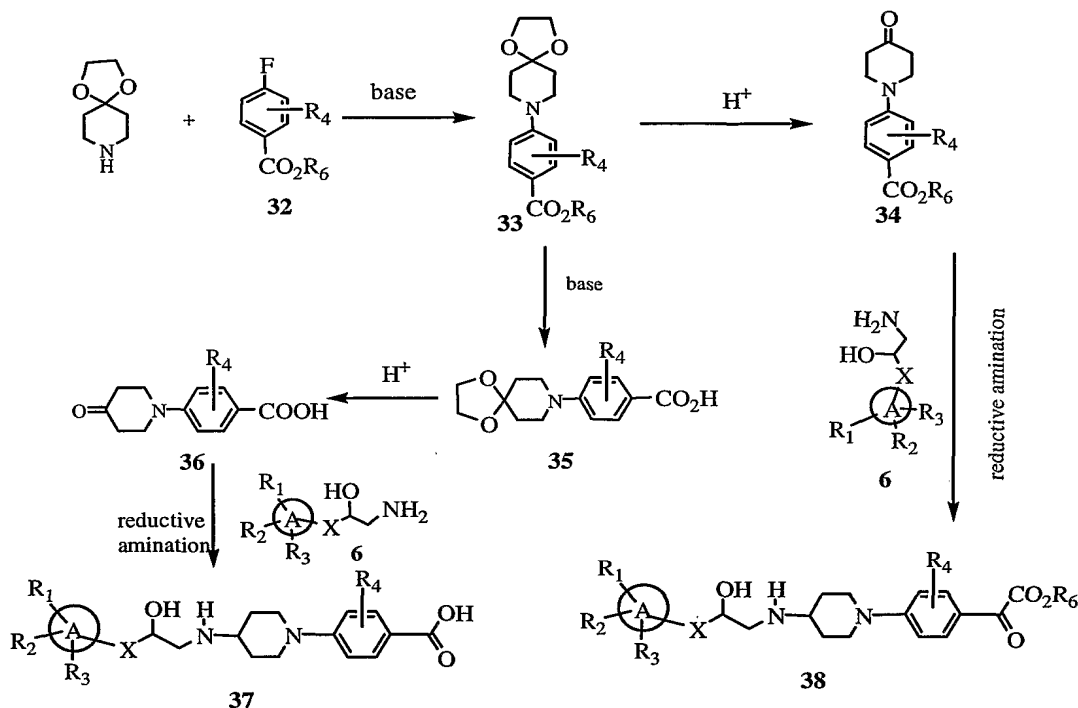
R₂, R₃, R₄ and X are as defined above. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid.

Scheme 6



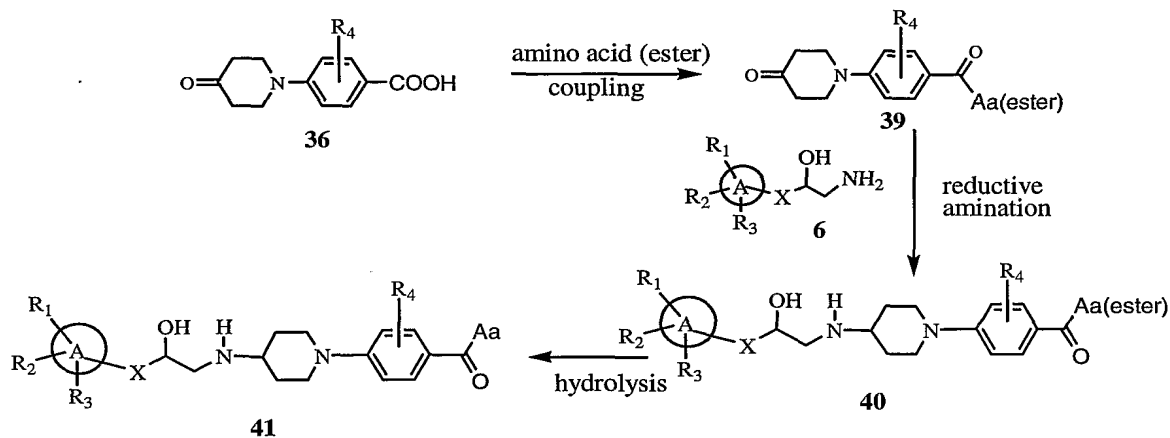
The compound represented by the above formula I wherein R₅ is acid or ester can be prepared by the following synthetic scheme (Scheme 7). According to one route, 1,4-dioxaspiro[4.5]decane is reacted with 4-fluorobenzoyl methyl ester **32** in the presence of base such as pyridine or potassium carbonate to afford ester **33**. This reaction can be carried out in a polar solvent such as anhydrous acetonitrile, acetone, dimethylformamide, or pyridine. Acid **35** is obtained via a basic hydrolysis of ester **33**. In this reaction lithium hydroxide, sodium hydroxide, potassium hydroxide and the like can be used as a base, and water or a mixture of water with methanol, ethanol, dioxane and the like can be used as a solvent. Ketal **35** hydrolysis is accomplished in the presence of strong acid such as concentrated hydrochloric acid or 10-30% sulfuric acid. The desired final product (acid **37**), wherein A, R₁, R₂, R₃, R₄ and X are as defined above, is prepared by utilizing reductive amination of piperidones **36** with appropriate aryloxypropanolamines or aryloxypropanolamines **6**, as previously described in Scheme 1. The corresponding ester **38**, wherein A, R₁, R₂, R₃, R₄, R₆ and X are as defined above (provided that in **38** R₆ can not be hydrogen), could be synthesized in the same manner starting with the ester **33** by ketal hydrolysis followed by reductive amination sequence. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid.

Scheme 7

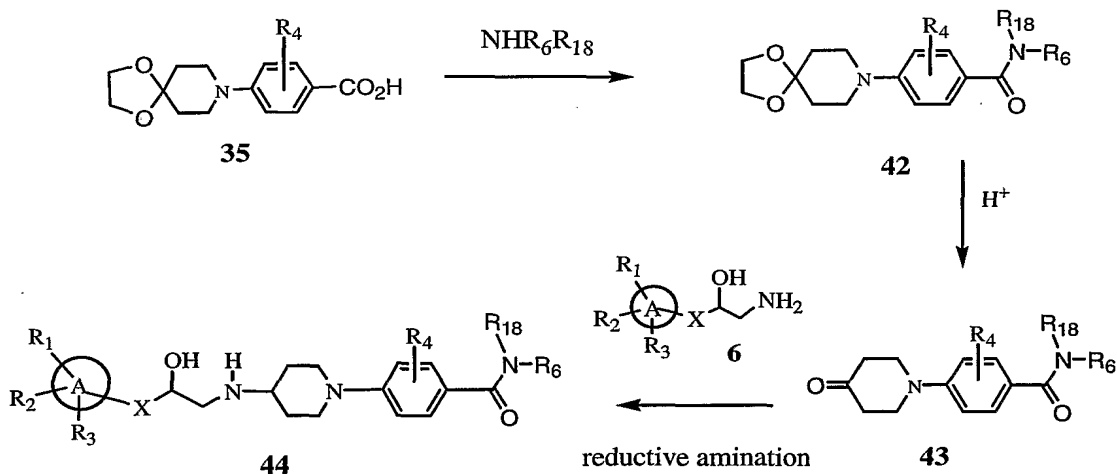


5 Mono peptide derived from the acid **36** and amino acid and its ester thereof, can be prepared by, for example, the following synthetic scheme (Scheme 8). The carboxylic acid **36** is coupled to the amine nitrogen of amino acid (ester), wherein the amino acid (ester) means the carboxylic acid functionality of the amino acid was protected as an ester. In this amide bond formation process 1,3-dicyclohexylcarbodiimide, 1-[3-(dimethylamino)propyl]-3-ethylcarbodiimide, diisopropylcarbodiimide, 1,1'-carbonyldiimidazole, 6-chloro-2,4-dimethoxy-1,3,5-triazine and the like can be used as a coupling agent and triethylamine, diisopropylethyl amine, N-methyl morpholine and the like can be used as a base. At this time, as a solvent, methylene chloride, diethyl ether, tetrahydrofuran, dioxane and the like is used. Reductive amination followed by ester hydrolysis, as previously described in Scheme 7, furnishes the desired final product **41**, wherein A, R_1 , R_2 , R_3 , R_4 , X and Aa are as defined above (Scheme 8). A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid. The corresponding hydroxamic acid or amide derivative **44**, wherein A, R_1 , R_2 , R_3 , R_4 , R_6 , R_{18} (R_{18} is either R_7 or OR_7) and X are as defined above, could be synthesized (Scheme 9) in an analogous manner starting with the acid **35** by amide bond formation between acid **35** and amine (NHR_6R_7) or hydroxylamine (NHR_6OR_7), followed by ketal hydrolysis and reductive amination, as previously described in Scheme 8. A salt is

optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid.

Scheme 8

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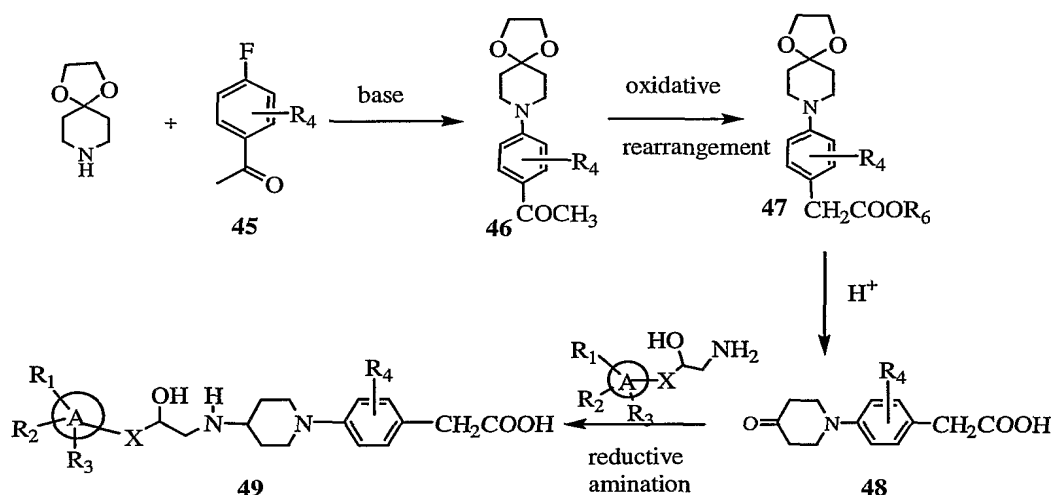
Scheme 9

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Homo analogues (here homo analogues means one carbon chain extended analogues) of compounds **37**, **38**, **41**, **44** can be prepared by, for example, the following synthetic scheme (Scheme 10). 1,4-Dioxo-8-azaspiro[4.5]decane is reacted with 4'-fluoroacetophenone **45**, as previously described in Scheme 1, to give acetophenone **46**. The methyl ketone compound **46** is converted into arylalkanoate **47** using an oxidative rearrangement procedure. In this reaction thallium(III) nitrate, iodine-silver nitrate and the like is used as an oxidation agent and an alcoholic solvent (R_6OH) such as methanol or ethanol is used as a solvent. Ketal and ester hydrolysis followed by reductive amination, as previously described in Scheme 1,

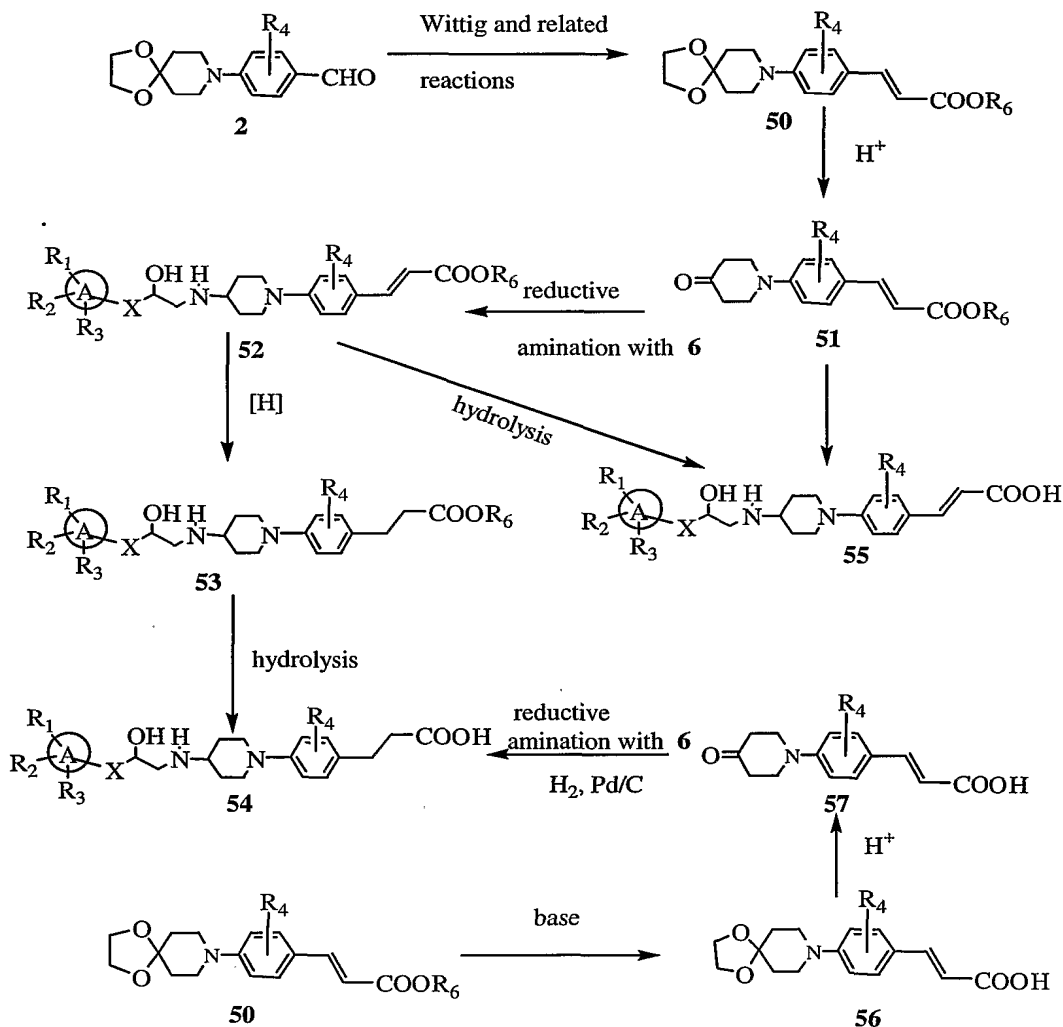
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generates the desired homo analog **49**, wherein A, R₁, R₂, R₃, R₄, and X are as defined above. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid. Homo analogues of mono peptide **41** or compound **44** derived from the acid **48** can be prepared in an analogous manner as previously described in Scheme 8 and Scheme 9.

Scheme 10

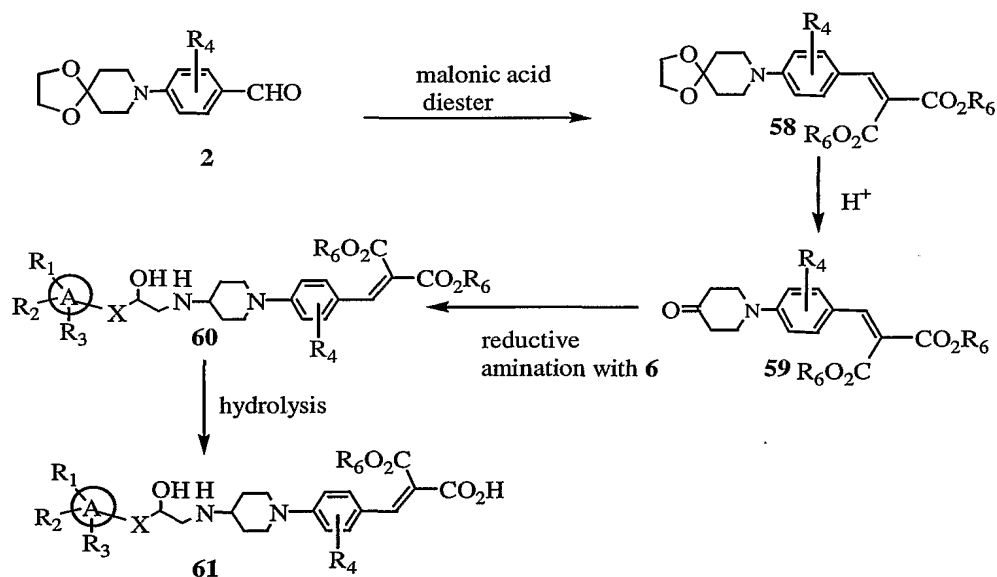
Two carbon chain extended analogues of compounds **37**, **38**, **41**, **44** can be prepared by, for example, the following synthetic scheme (Scheme 11). Compound **50** can be obtained by a Wittig or related reaction between aldehyde **2** and a Wittig reagent in the presence of a base. In this reaction diethyl ethoxycarbonylmethanephosphonate, (ethoxycarbonylmethyl) triphenylphosphonium chloride, triphenyl(ethoxy-carbonylmethyl)phosphonium bromide and the like can be used as a Wittig reagent and lithium diisopropylamide, sodium hydride, potassium hydroxide and the like can be used as a base. Ketal hydrolysis under acidic conditions followed by reductive amination, as previously described in Scheme 1, generates the desired olefinic analog **52**, wherein A, R₁, R₂, R₃, R₄, R₆, and X are as defined above. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid. The corresponding olefinic acid analog **55**, wherein A, R₁, R₂, R₃, R₄, and X are as defined above, can be obtained by a basic hydrolysis process. In this case, lithium hydroxide, sodium hydroxide and the like can be used as a base and aqueous methanol, ethanol, tetrahydrofuran and the like can be used as a solvent. The carbon-carbon double bond of compound **52** can be reduced by catalytic hydrogenation in the presence of a metal catalyst such as palladium, platinum, rhodium and the like to give the reduced analog **53**, wherein A, R₁, R₂, R₃, R₄, R₆ and X are as defined above. An alcohol such as methanol, ethanol, isopropanol and the like, acetic acid, tetrahydrofuran, dioxane can be used as solvent

in the hydrogenation. The corresponding propanic acid analog **54**, wherein A, R₁, R₂, R₃, R₄ and X are as defined above, was produced by basic hydrolysis of **53**, as previously described in Scheme 7. Alternatively, ester **50** is treated with a base to produce the acid **56**, which in turn is treated with a strong acid to remove the protecting ketal group of **56**, thus exposing the terminal ketone for a reductive amination process (with hydrogen and catalytic palladium) to generate the same compound **54**. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid. Mono peptide **41** or compound **44** analogues derived from compound **51** or **57** can be prepared in an analogous manner as previously described in Scheme 8 and Scheme 9.

Scheme 11

Malonic acid analogues of compounds **37**, **38**, **41**, **44** can be prepared as described in Scheme 12 starting from compound **2**. A Knoevenagel condensation between a malonic acid

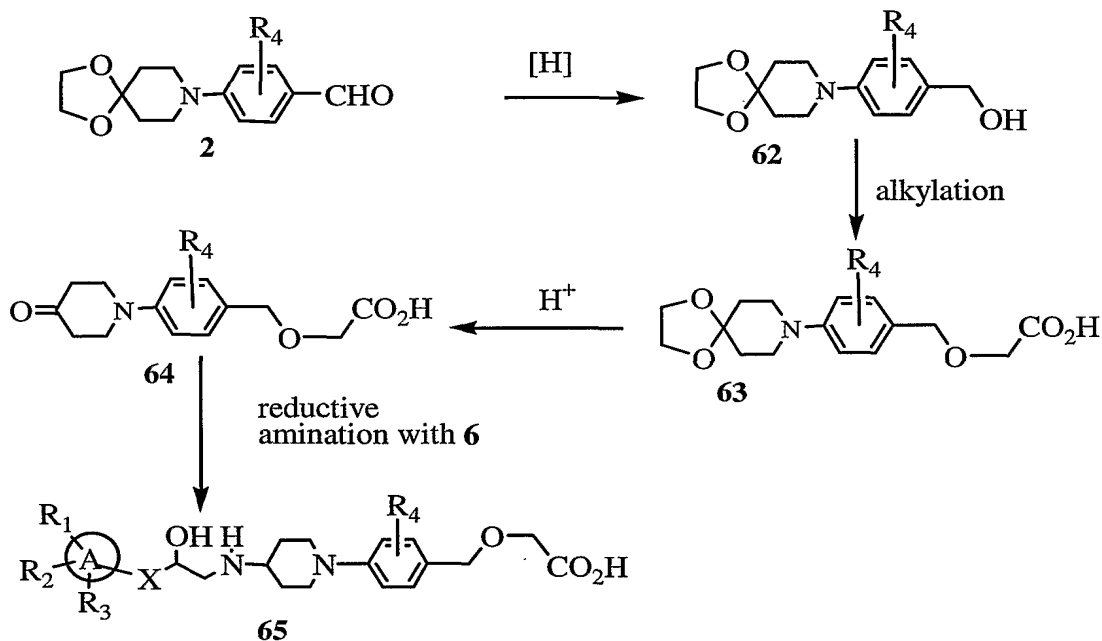
diester and the aldehyde **2** yields compound **58**. In this reaction sodium acetate, piperidine, piperidinium acetate, pyrrolidine, potassium acetate, sodium carbonate and the like can be used as a base, and an alcohol such as methanol, ethanol, isopropanol, methoxyethanol and the like can be used as a solvent. Ketal hydrolysis followed by reductive amination of piperidione **59** with amine **6**, as previously described in Scheme 1, gives the malonic acid analog **60**, wherein A, R₁, R₂, R₃, R₄, R₆ (provided that in **60** R₆ can not be hydrogen) and X are as defined above. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid. The diester group in compound **60** could be converted to mono acid or diacid by a basic hydrolysis process, which is well known in the art, to yield compound **61** wherein A, R₁, R₂, R₃, R₄, R₆ and X are as defined above. Mono peptide **41** or compound **44** analogues derived from compound **59** can be prepared in an analogous manner as previously described in Scheme 8 and Scheme 9.

Scheme 12

Ether analogues of compounds **37**, **38**, **41**, **44** can be prepared by, for example, the following synthetic scheme (Scheme 13). The aldehyde group in compound **2** is reduced by a reducing agent such as sodium borohydride, in an alcoholic solvent, e.g., methanol to yield alcohol **62**. Alcohol **62** is alkylated with, for example, iodoacetate sodium salt to generate acid **63**, which is then converted to ether analog **65**, wherein A, R₁, R₂, R₃, R₄ and X are as defined above, using ketal hydrolysis/reductive amination sequence as previously described in Scheme 1. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid. Mono peptide **41** and compound **44** analogues derived from

compound **64** can be prepared in an analogous manner as previously described in Scheme 8 and Scheme 9.

Scheme 13



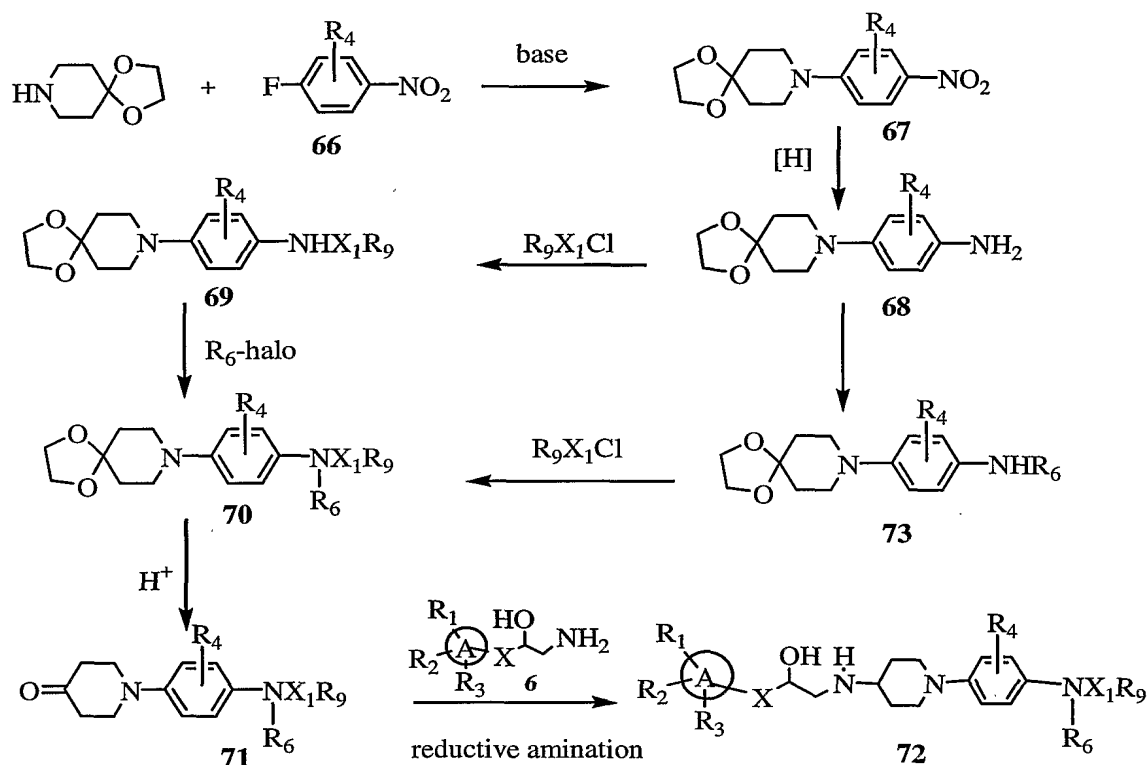
Sulfonamide or amide **72** can be conveniently prepared by a variety of methods known in the art. According to one route (Scheme 14), 1,4-dioxaspiro[4.5]decane is reacted with 4-nitroaryl fluoride **66** in the presence of base such as pyridine or potassium carbonate to afford ketal **67**. This reaction can be carried out in a polar solvent such as anhydrous acetonitrile, acetone, dimethylformamide, or pyridine. The nitro group is then reduced by, for example, catalytic hydrogenation to provide aniline **68**. The aniline **68** could be acylated with either sulfonyl chlorides or acyl chlorides in the presence of base such as triethylamine or pyridine to give the corresponding acylation product **69**. Compound **69** could be optionally alkylated with appropriate alkylating agents (R_6 -halo) in the presence of base such as potassium carbonate to give the alkylated product **70**. Alternatively, a sequence of reductive amination between aniline **68** and appropriate aldehydes or ketones followed by acylation with R_9X_1Cl furnishes the same alkylated product **70**. Ketal hydrolysis followed by reductive amination of piperidiones **71** with amine **6** as previously described in Scheme 1, gives the sulfonamide or amide analog **72**, wherein A, X, X_1 , R_1 , R_2 , R_3 , R_4 , R_6 and R_9 are as defined above. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid.

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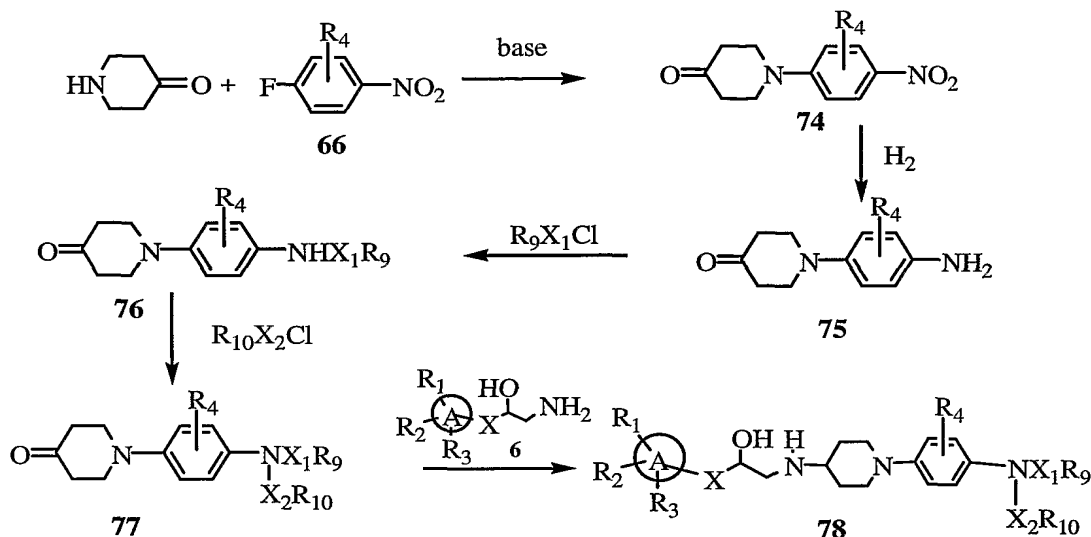
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Scheme 14



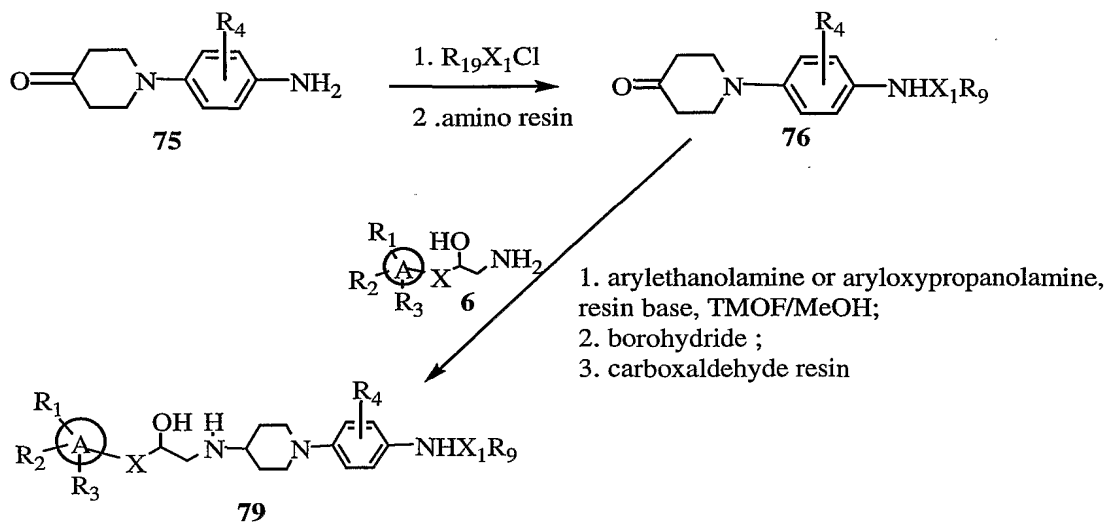
- 5 Diacylated amine derivatives **78** are also readily prepared by methods known in the literature. For example, as shown in Scheme 15, the hydrochloric salt of 4-piperidone is condensed with 4-nitroarylfluorides, conveniently in pyridine, to give piperidone **74**. The nitro group in **74** is then reduced to the corresponding aniline by catalytic hydrogenation as previously described. Diacylation of aniline **75** by R_9X_1Cl followed by $R_{10}X_2Cl$ (R_9X_1Cl and
- 10 $R_{10}X_2Cl$ could be the same in some cases) gives the desired intermediate **77**, which could be converted to the final product **78**, wherein A, X, X_1 , X_2 , R_1 , R_2 , R_3 , R_4 , R_6 , R_9 and R_{10} are as defined above, by a reductive amination process as previously described in Scheme 1.

Scheme 15



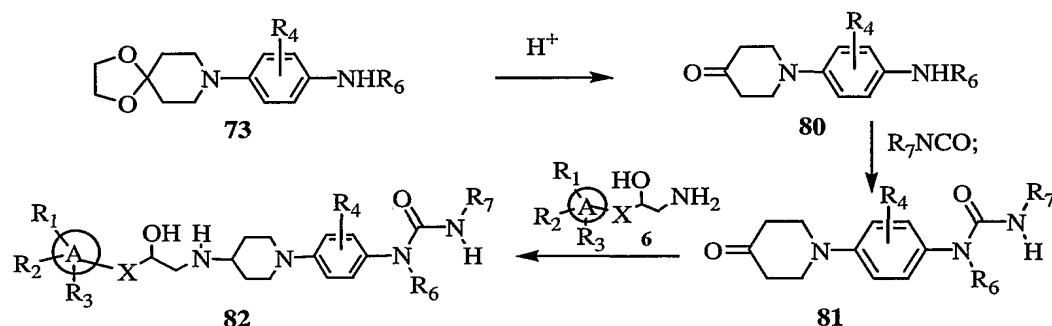
Some of the compounds of the present invention are prepared by a novel solution phase methodology (Scheme 16). In this method the product is formed in solution phase reactions and excess reagents are removed from solutions by solid scavenging agents. Treatment of aniline **75** with excess sulfonyl chloride and an resin base such as (piperidinomethyl)polystyrene in a solvent such as dichloromethane or 1,4-dioxane for 1 to 24 hours at room temperature gives the desired sulfonamide **76**. The excess sulfonyl chloride is then removed by a nucleophilic scavenging agent, for example, aminomethylated polystyrene resin. The intermediate piperidone **76** could be isolated by filtration and evaporation. The imine formation between the piperidones and excess aryloxypropanolamines is accomplished in a solvent such as methanol and in a water scavenging agent such as trimethyl orthoformate. The imine reduction is achieved by using a solid supported borohydride such as Amberlite IRA-400 borohydride resin. The excess amine is readily removed by quenched with a carboxaldehyde resin such as formylpolystyrene. The final product **79**, wherein A, X, X₁, R₁, R₂, R₃, R₄, R₆ and R₉ are as defined above, could be purified by the same manner as described in Scheme 1.

Scheme 16



- 5 The compounds of the present invention where acidic group R_5 is urea can be prepared starting from aniline **73**, as shown in Scheme 17. Aniline **80** is available from **73** by treatment of **73** with strong acid such as aqueous concentrated hydrochloric acid. Aniline **80** can be added to isocyanates to give the corresponding substituted urea **81**. A reductive amination between amine **6** and **81**, as previously described, gives the desired urea **82**, wherein A, R_1 , R_2 , R_3 , R_4 , R_6 , R_7 and X are as defined above. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid.

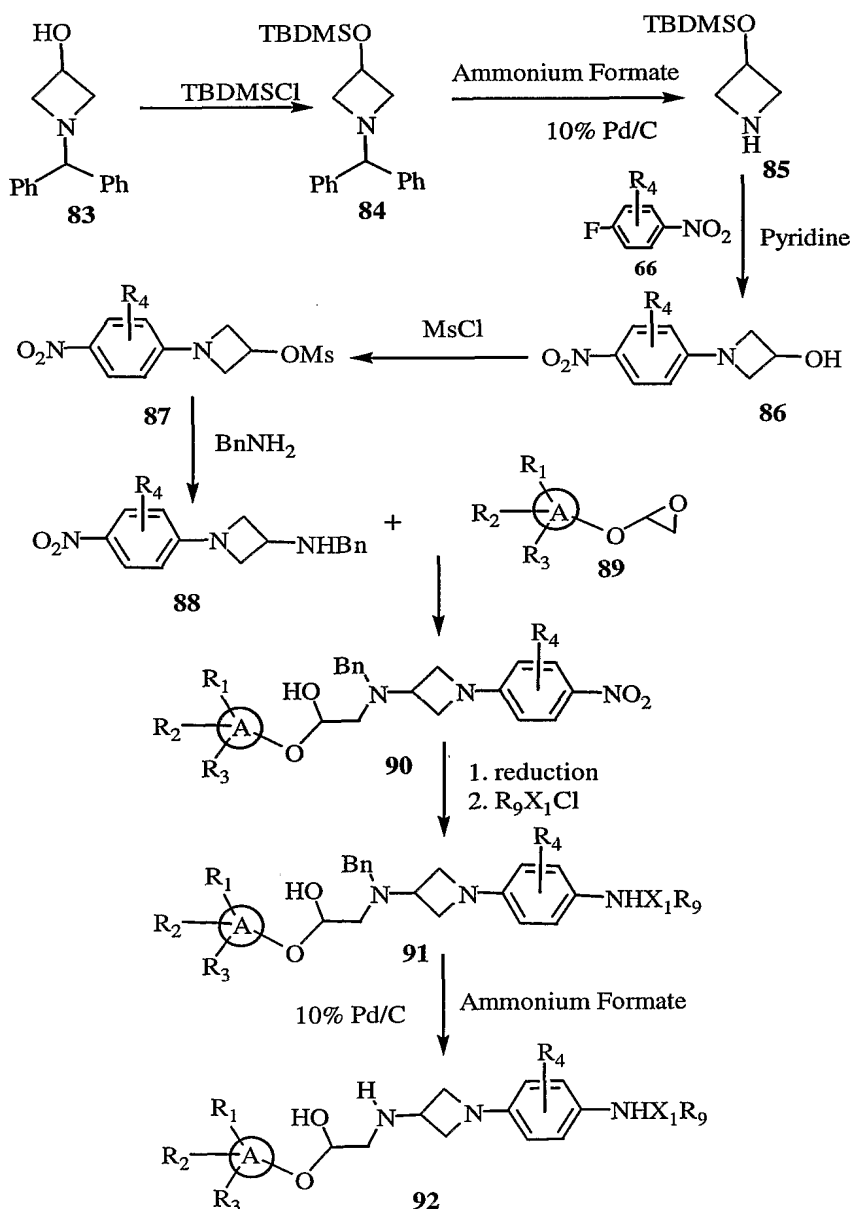
Scheme 17



- 15 The compounds of the present invention where the cyclic amine is azetidine can be prepared as illustrated in Scheme 18. The alcohol of **83** is protected, for example, as its t-butyldimethylsilyl(TBS) ether to give TBS derivative **84**. The protecting diphenylmethyl group in **84** is then removed by treatment of **84** with ammonium formate in the presence of palladium catalyst or raney nickle, typically in refluxing methanol. Condensation of azetidine **85** with arylfluoride **66** as before gives the key intermediate **86**. The alcohol of **86** is then converted to the corresponding amine **88** by treatment with mesyl (Ms) chloride followed by benzylamine.

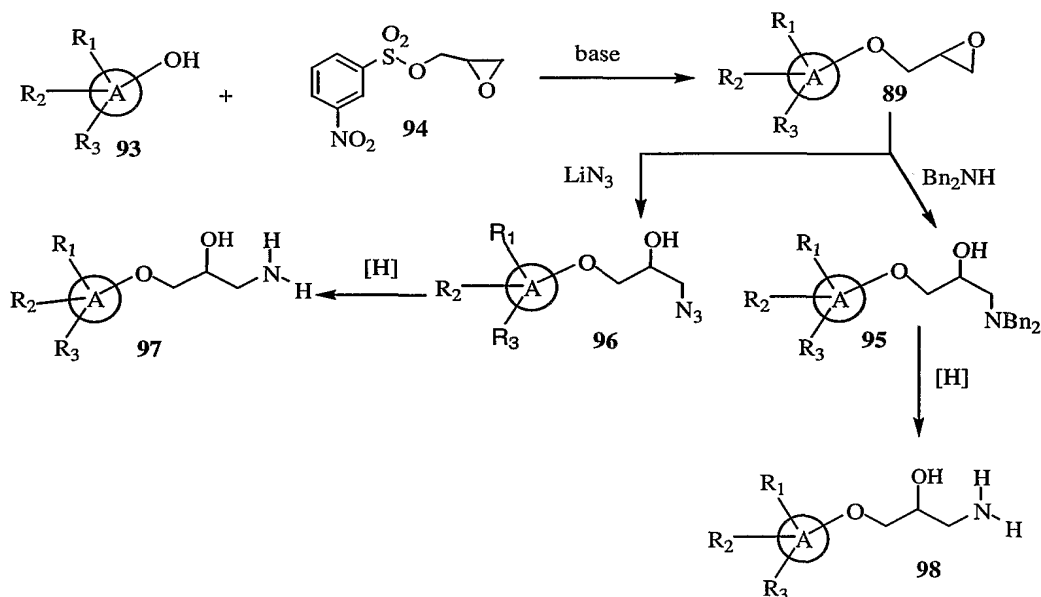
The epoxides **89**, many of which are commercially available or can be readily prepared as described in Scheme 19, are coupled with amine **88** by heating them neat or in a polar solvent. Preferably, the reaction is carried under refluxing methanol. The nitro group in **90** is then reduced, for example, by sodium hydrosulfite, to give an aniline. The aniline is then acylated with sulfonyl chloride, acyl chloride or isocyanates followed by deprotection of benzyl group with ammonium formate/palladium on carbon to give the desired azitidine **92**, wherein A, R₁, R₂, R₃, R₄, R₉ and X₁ are as defined above. A salt is optionally produced by the addition of an acid or base, such as hydrogen chloride gas or hydrochloric acid.

10

Scheme 18

Many of arylethanolamines or aryloxypropanolamines **6** are commercially available or readily prepared by known methods [1. Guy, A., Ferroud, D. C., Garreay, R., Godefroy-Falguieres A. *Synthesis*, **1992**, 821; 2. Leclerc, G., Bizec, J. C. *J. Med. Chem.*, **1980**, *23*, 738; 3. Tominaga, M., Ogawa, H., Yo, E., Yamashita, S., Yabuuchi, Y., Nakagawa, K. *Chem. Pharm. Bull.* **1987**, *35*, 3699]. In one route (Scheme 19) equimolecular amounts of alcohol **93** and enantiomerically pure (2S)-glycidyl 3-nitrobenzene sulfonate **94** are dissolved in an organic solvent such as acetone or N,N-dimethylformamide and treated with a base such as sodium hydride or potassium carbonate for 0.5 to 24 hours at a temperature of 20-100 °C to provide oxirane **89**. The oxirane **89** is converted to the corresponding amine **97** or **98**, wherein A, R₁, R₂, and R₃ are as defined above (provided that in **98** R₁, R₂, and R₃ can not be benzyloxy), by regioselective ring opening of oxirane **89** with either lithium azide in a solvent such as hexamethylphosphoramide (HMPA) followed by reduction with, for example, triphenylphosphine in aqueous tetrahydrofuran, or with one equivalent of dibenzylamine followed by ammonium formate/palladium on carbon reduction. The other enantiomer is available through an analogous preparative sequence with the corresponding (2R)-glycidyl 3-nitrobenzene sulfonate.

Scheme 19

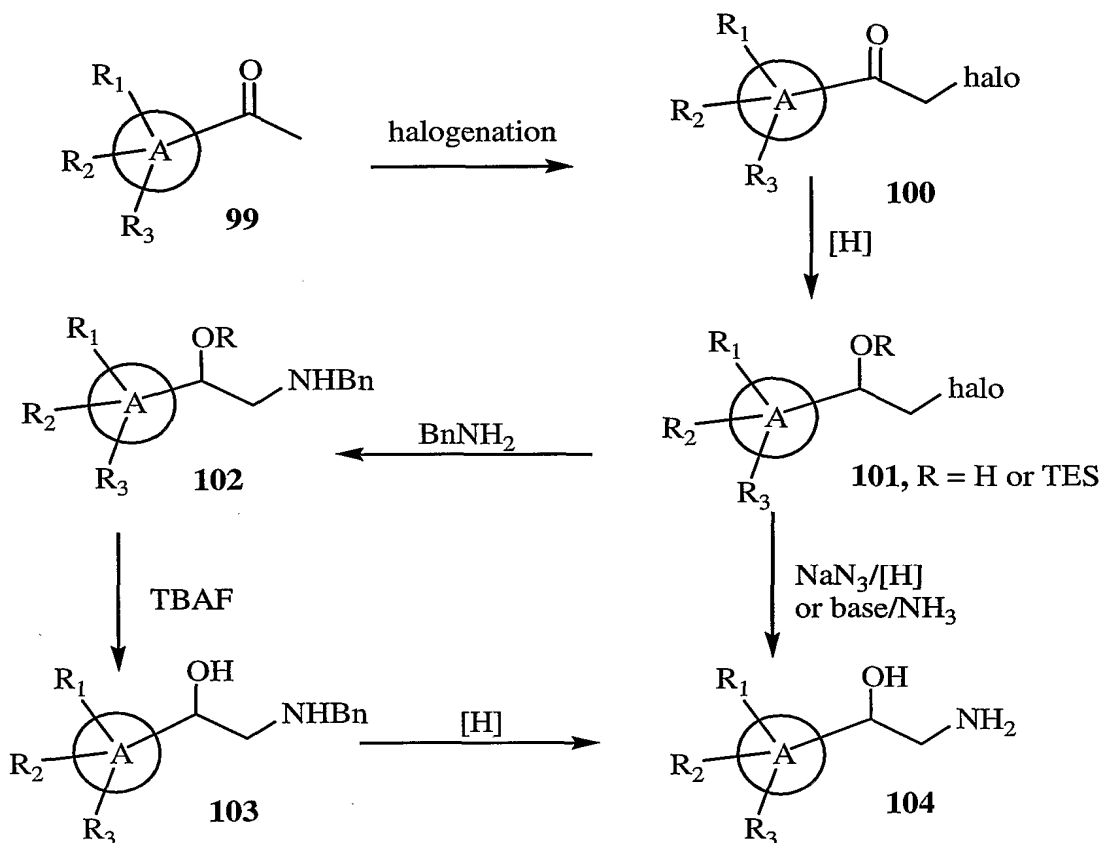


One route to the desired arylethanolamines **6** is illustrated in Scheme 20. Methylketones **99** are all available commercially or can be prepared by conventional methods disclosed in the art. Compound **99** can be easily converted to the corresponding α -haloketone

100, wherein halo is chlorine, bromine or iodine, using well known halogenation agents such as chlorine, bromine, N-chlorosuccinimide, N-bromosuccinimide and the like. The resultant α -haloketone **100** is then reduced, for example, by sodium borohydride, to give the corresponding racemic alcohol **101**. An enantiomerically enriched alcohol **101** may be prepared
5 by asymmetric reduction of α -haloketone **100** with chiral reducing agents such as (+) or (-)-B-chlorodiisopinocampheylborane (DIP-Cl), R or S-Alpine borane, cis-(1R, 2S) or cis (1S, 2R)-oxazaborolidine and the like. The alcohol of intermediate **101** may be protected, for example, as its triethylsilyl ether. In some cases, however, the alcohol protecting group is not required. The halo compound **101** can be easily converted to the corresponding benzylamine **102** by
10 heating to 30-80 °C with large excess of benzylamine neat or as a solution in a polar solvent such as tetrahydrofuran, acetonitrile or methanol for 1 to 24 hours. The protecting group is then removed, in the case of silyl ether, by treatment of **102** with a fluoride agent such as tetrabutylammonium fluoride (TBAF). Compound **103** is then subjected to catalytic hydrogenation in the presence of ammonium formate/Pd to give the desired aminoethanol **104**,
15 wherein A, R₁, R₂ and R₃ are as defined above. The reduction is conveniently conducted in refluxing methanol in the presence of a large excess of ammonium formate.

Alternatively, the halo compound **101** could be converted to the corresponding amine **104** by either treatment with a sodium azide/sodium iodide mixture in a polar solvent such as dimethyl sulfoxide, hexamethylphosphoramide and the like followed by catalytic hydrogenation
20 in the presence of a metal catalyst such as palladium, platinum and the like; or treatment with a base such as sodium hydroxide, potassium carbonate or the like followed by ammonia in a polar solvent such as methanol, tetrahydrofuran or the like.

Scheme 20



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The compounds of this invention are useful in treating metabolic disorders related to insulin resistance or hyperglycemia, typically associated with obesity or glucose intolerance. The compounds of this invention are therefore, particularly useful in the treatment or inhibition of type II diabetes. The compounds of this invention are also useful in modulating glucose levels in disorders such as type I diabetes.

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The ability of compounds of this invention to treat or inhibit disorders related to insulin resistance or hyperglycemia was confirmed with representative compounds of this invention in the following standard pharmacological test procedures, which measured the binding selectivity to the β_1 , β_2 , and β_3 adrenergic receptors. Binding to the receptors was measured in Chinese Hamster ovary (CHO) cells that were transfected with adrenergic receptors. The following briefly summarizes the procedure used and results obtained.

15

Transfection of CHO cells with β_1 and β_2 adrenergic receptors: CHO cells were transfected with human β_1 - or β_2 -adrenergic receptors as described in *Tate, K.M., , Eur. J. Biochem., 196:357-361 (1991)*.

Cloning of Human β_3 -AR Genomic DNA: cDNA was constructed by ligating four
 5 polymerase chain reaction (PCR) products using the following primers: an ATG-NarI fragment, sense primer 5'-CTTCCCTACCGCCCCACGCGCGATC3' and anti-sense primer 5'-CTGGCGCCCAACGGCCAGTGGCCAGTC3'; a NarI-AccI fragment, 5'-TTGGCGCTGATGGCCACTGGCCGTTTG3' as sense and 5'-GCGCGTAGACGAAGAGCATCACGAG3' as anti-sense primer; an AccI-StyI fragment,
 10 sense primer 5'-CTCGTGATGCTCTTCGTCTCACGCGC3' and anti-sense primer 5'-GTGAAGGTGCCCCATGATGAGACCCAAGG3' and a StyI-TAG fragment, with sense primer 5'-CCCTGTGCACCTTGGGTCTCATCATGG3' and anti-sense primer 5'-CCTCTGCCCCGGTTACCTACCC3'. The corresponding primer sequences are described in *Mantzoros, C.S., et.al., Diabetes 45: 909-914 (1996)*. The four fragments are ligated into a
 15 pUC 18 plasmid (Gibco-BRL) and sequenced. Full length β_3 AR clones (402 amino acids) containing the last 6 amino acids of h β_3 -AR are prepared with the β_3 - β ARpcDNA3 from ATTC.

Binding Procedure: Clones expressing receptor levels of 70 to 110 fmoles/mg protein were used in the test procedures. CHO cells were grown in 24-well tissue culture plates in
 20 Dulbecco's Modified Eagle Media with 10% fetal bovine serum, MEM non-essential amino acids, Penicillin-Streptomycin and Geneticin. On the day of test procedure, growth medium was replaced with preincubation media (Dulbecco's Modified Eagle Media) and incubated for 30 minutes at 37° C. Preincubation medium was replaced with 0.2 ml treatment medium containing DMEM media containing 250 μ M IBMX (isobutyl-1-methylxanthine) plus 1 mM
 25 ascorbic acid with test compound dissolved in DMSO. Test compounds were tested over a concentration range of 10^{-9} M to 10^{-5} M for β_3 cells and 10^{-8} to 10^{-4} M for β_1 and β_2 transfected cells. Isoproterenol (10^{-5} M) was used as an internal standard for comparison of activity. Cells were incubated at 37° C on a rocker for 30 min with the β_3 cells and 15 min for
 30 β_1 and β_2 cells. Incubation was stopped with the addition of 0.2N HCl and neutralized with 2.5N NaOH. The plates, containing the cells and neutralized media, were stored at -20 degrees celsius until ready to test for cAMP using the SPA test kit (Amersham).

Data Analysis and Results: Data collected from the SPA test procedure were analyzed as per cent of the maximal isoproterenol response at 10^{-5} M. Activity curves were

plotted using the SAS statistical and graphics software. EC₅₀ values were generated for each compound and the maximal response (IA) developed for each compound is compared to the maximal response of isoproterenol at 10⁻⁵ M from the following formula:

$$IA = \frac{\% \text{ activity compound}}{\% \text{ activity isoproterenol}}$$

Table I shows the β_3 -adrennergic receptor EC₅₀ and IA values for the representative compounds of this invention that were evaluated in this standard pharmacological test procedure. These results show that compounds of the present invention have activity at the β_3 -adrennergic receptor. The compounds of this invention had weaker or no activity at β_1 and/or β_2 -adrennergic receptor.

Table I

Compound No.	EC ₅₀ (β_3 , μ M)	IA(β_3)
Example 63	20	1
Example 64	3	1
Example 65	34	1.1
Example 66	8	0.81
Example 67	9	1.06
Example 68	8	1
Example 69	6	1
Example 70	0.7	1.2
Example 71	1	1.2
Example 72	89	0.68
Example 73	40	0.71
Example 74	233	0.23
Example 75	2	1.08
Example 76	33	0.94
Example 77	6	1.03
Example 78	9	1.1
Example 79	167	0.56
Example 80	1	1.1
Example 81	12	0.89

Compound No.	EC ₅₀ (β ₃ , μM)	IA(β ₃)
Example 82	63	1.07
Example 83	33	0.68
Example 84	10	1.19
Example 85	34	0.94
Example 86	380	0.69
Example 87	230	1
Example 88	9	1
Example 89	24	1.1
Example 90	86	1.2
Example 91	13	1.2
Example 92	3	1.1
Example 93	0.4	1
Example 95	660	0.59
Example 96	6	0.93
Example 97	49	0.9
Example 98	5	1
Example 99	132	0.97
Example 100	43	0.9
Example 122	179	0.46
Example 125	760	0.36
Example 131	1,320	0.52
Example 136	900	0.9
Example 146	17	0.91
Example 179	89	0.85
Example 180	4	1
Example 181		0.56
Example 182	197	0.86
Example 183	42	0.84
Example 184	65	1.1
Example 185	53	0.69
Example 186	179	1.1
Example 187	37	1.03
Example 188	9	0.91
Example 189	10	1.3

Compound No.	EC ₅₀ (β ₃ , μM)	IA(β ₃)
Example 190	23	1.12
Example 191	4	1
Example 192	20	0.97
Example 193	5	0.9
Example 194	7,124	0.88
Example 195	195	0.98
Example 196	9	1.1
Example 197	40	0.94
Example 198	1	0.97
Example 199	8	1
Example 200	4	1.1
Example 201	55	1.1
Example 202	8	1.2
Example 203	16	1.1
Example 204	3	1.2
Example 205	7	1.2
Example 206	16	0.94
Example 207	9	1
Example 208	13	0.97
Example 209	2	1
Example 210	55	1.36
Example 211	8	1
Example 212	9	1.1
Example 213	6	0.97
Example 255	1,360	0.72
Example 256	910	0.85
Example 257	610	0.88
Example 258	3,126	0.7
Example 259	916	0.97
Example 260	3,755	0.63
Example 261	12,185	0.73
Example 263	8	0.93
Example 264	1,830	0.37
Example 265	94	0.8

Compound No.	EC ₅₀ (β ₃ , μM)	IA(β ₃)
Example 266	10	0.86
Example 267	15,400	0.99
Example 268	797	0.64
Example 270	21	1.09
Example 271	20	0.84
Example 272	1,553	0.57
Example 273	3,840	1.05
Example 274	165	1.15
Example 275	100	0.73
Example 276	1	1.1
Example 277	3	0.58
Example 278	10	1.04
Example 279	470	0.74
Example 280	20	1.16
Example 281	9	1.14
Example 282	22	0.63
Example 283	10	0.81
Example 284	20	0.87
Example 285	39	0.76
Example 286	9	0.91
Example 287	10	0.92
Example 288	66	1.24
Example 289	70	0.59
Example 290	34	0.72
Example 291	13	1.07
Example 292	3	0.75
Example 293	210	0.94
Example 294	33	1.07
Example 295	6	0.87
Example 296	8	0.81
Example 297	16	1
Example 298	59	0.78
Example 299	0.6	1.1
Example 300	55	0.78

Compound No.	EC ₅₀ (β ₃ , μM)	IA(β ₃)
Example 301	30	0.95
Example 302	10	0.95
Example 303	20	0.96
Example 304	110	0.35
Example 305	1	1
Example 306	5	1.1
Example 307	4	1
Example 308	2	1.4
Example 309	1	1
Example 310	25	1
Example 311	210	0.82
Example 312	1	1.1
Example 313	13	1
Example 315	1	1.2
Example 317	50	0.97
Example 318	13	1
Example 319	4,160	0.79
Example 320	11	0.87
Example 321	13	1.05
Example 322	2	0.89
Example 323	35	0.92
Example 324	4	0.9
Example 325	4	1
Example 326	79	1.3
Example 327	6	0.86
Example 328	8	0.89
Example 329	15	0.9
Example 330	12	0.98
Example 331	9	1
Example 332	20	1.1
Example 333	13	0.83
Example 334	40	0.91
Example 335	3	0.98
Example 336	20	0.82

Compound No.	EC ₅₀ (β ₃ , μM)	IA(β ₃)
Example 337	29	0.72
Example 338	4	1
Example 339	10	0.89
Example 342	3	1
Example 343	20	0.86
Example 345	4	1
Example 346	1,580	0.76
Example 347	14	0.91
Example 348	95	0.63
Example 349	390	1.26
Example 350	1,070	1.26
Example 351	888	0.76
Example 352	109	1.02
Example 353	1,380	0.97
Example 354	283	0.73
Example 357	96	0.87
Example 358	33	1.1
Example 359	73	0.91
Example 360	155	0.54
Example 361	1,134	0.55
Example 362	30	0.9
Example 371	10	0.91
Example 372	127	1
Example 373	9	1.1
Example 374	9	1.2
Example 375	1	1
Example 376	1	1
Example 377	16	0.66
Example 378	56	0.94
Example 379	13	0.93
Example 380	8	1.1
Example 381	57	0.97
Example 382	19	0.64
Example 383	740	0.64

Compound No.	EC ₅₀ (β_3 , μ M)	IA(β_3)
Example 384	199	0.64
Example 385	55	1.12
Example 386	51	0.89
Example 387	168	0.56
Example 388	740	0.75
Example 389	50	0.61
Example 390	14	0.82
Example 391	337	0.81
Example 392	18	0.9
Example 393	10	1
Example 394	66	1.3
Example 411	954	0.49
Example 412	1,329	0.56
Example 413	580	0.73
Example 415	537	0.35
Example 416	53	0.48
Example 417	24	0.71

Evaluation in β_3 Knockout(KO) and β_3 Transgenic(Tg) Mice: The ability of compounds of this invention to treat or inhibit disorders related to insulin resistance or hyperglycemia was also confirmed with representative compounds of this invention in an *in vivo* standard pharmacological test procedure which compared thermogenesis in transgenic mice (Tg mice) and β_3 -knockout mice (KO mice). The procedure used and results obtained are provided below.

β_3 -Adrenergic receptor knockout mice and β_3 human transgenic mice are created on an inbred FVB background (Susulic, V.S., et.al., *J. Biol. Chem.*, **1995**, 270 (49), 29483-29492). Female FVB β_3 transgenic and β_3 knockout mice were used to determine *in vivo* activity and selectivity of β_3 agonists. Compounds selected for *in vivo* testing had β_3 EC₅₀<30 nm and were full agonists in CHO cells expressing human β_3 receptors. These compounds were also selective in being 100-fold less responsive and partial agonists when tested in β_1 and β_2 transfected CHO cells. Compounds were tested for increased thermogenesis using the

Oxymax indirect calorimeter (Columbus Instruments, Columbus, Ohio). Fed animals were placed in chambers for 3 hours to obtain baseline O₂ and CO₂ values. Eight fed mice were weighed in pairs and placed in 4 chambers, two per chamber. The relative gas content of each chamber was sampled and recorded at 10 to 12 minute intervals. For each sample, energy expenditure values were calculated by the Oxymax and expressed as kcal/hr. After 3 hours of baseline measurement, the mice were removed, treated and replaced in the chambers. The β_3 agonists were injected at doses between 0.1 and 20 mg/kg i.p. and between 1.0 and 30 mg/kg for oral administration. Compounds in 10 mM or 10 mg/ml DMSO solutions were suspended in 0.5% methylcellulose: 0.1% tween-80 and injected i.p. or administered by oral gavage. Some compounds were suspended in 5.0% tween-80 for oral administration. Post-treatment kcal/hr values were taken between 40 minutes and 2.5 hours later. The 6 to 10 sample sections of the pre-treatment and post-treatment periods, which appear to best represent stable resting thermogenesis, were selected. Each of these sample values was corrected for body weight and used such that each pair of mice serves as its own baseline for both T test and percent increase in thermogenesis calculations. An ANOVA and a one sided T test (H1: Post>Pre) are performed using the SAS software modified to down weight extreme values. In a separate set of calculations, values that appear to be too high to represent resting thermogenesis are discarded (activity monitor sampling associated spikes in thermogenesis with ambulatory activity). The mean baseline value for each chamber is subtracted from mean post-treatment value for that chamber. This baseline-subtracted value is divided by the mean baseline value and multiplied by 100 to obtain a percent increase in thermogenesis for each chamber. The combined mean percent increase, standard deviation, and standard error of the mean for each chamber is calculated. Compounds were considered active if they were able to produce a statistically significant 15% increase in thermogenesis in β_3 transgenic mice and no significant increase in β_3 knockout mice. The results are shown in the table below.

Thermogenesis in β_3 Knockout(KO) and β_3 Transgenic(Tg) Mice

Compound No#	Thermogenesis (Tg mice)	Thermogenesis (KO mice)
Example 63	30 \pm 8%	16 \pm 4%
Example 84	30 \pm 4%	-2 \pm 4%
Example 180	42 \pm 4%	9 \pm 5%
Example 186	77 \pm 12%	16 \pm 7%
Example 189	33 \pm 7%	6 \pm 3%

Based on the results obtained in these standard pharmacological test procedures, representative compounds of this invention have been shown to be selective β_3 adrenergic
5 receptor agonists and are therefore useful in treating metabolic disorders related to insulin resistance or hyperglycemia (typically associated with obesity or glucose intolerance), atherosclerosis, gastrointestinal disorders, neurogenetic inflammation, glaucoma, ocular hypertension, and frequent urination; and are particularly useful in the treatment or inhibition of type II diabetes, and in modulating glucose levels in disorders such as type I diabetes. As
10 used herein, the term modulating means maintaining glucose levels within clinically normal ranges.

As used in accordance with this invention, the term providing an effective amount means either directly administering such a compound of this invention, or administering a
15 prodrug, derivative, or analog which will form an effective amount of the compound of this invention within the body.

It is understood that the effective dosage of the active compounds of this invention may vary depending upon the particular compound utilized, the mode of administration, the
20 condition, and severity thereof, of the condition being treated, as well as the various physical factors related to the individual being treated. As used in accordance with invention, satisfactory results may be obtained when the compounds of this invention are administered to the individual in need at a daily dosage of from about 0.1 mg to about 1 mg per kilogram of body weight, preferably administered in divided doses two to six times per day, or in a
25 sustained release form. For most large mammals, the total daily dosage is from about 3.5 mg to about 140 mg. It is preferred that the administration of one or more of the compounds herein begin at a low dose and be increased until the desired effects are achieved.

Such doses may be administered in any manner useful in directing the active
30 compounds herein to the recipient's bloodstream, including orally, via implants, parenterally (including intravenous, intraperitoneal and subcutaneous injections), rectally, intranasally, vaginally, and transdermally. For the purposes of this disclosure, transdermal administrations are understood to include all administrations across the surface of the body and the inner linings of bodily passages including epithelial and mucosal tissues. Such administrations may
35 be carried out using the present compounds, or pharmaceutically acceptable salts thereof, in

lotions, creams, foams, patches, suspensions, solutions, and suppositories (rectal and vaginal).

Oral formulations containing the active compounds of this invention may comprise any conventionally used oral forms, including tablets, capsules, buccal forms, troches, lozenges and oral liquids, suspensions or solutions. Capsules may contain mixtures of the active compound(s) with inert fillers and/or diluents such as the pharmaceutically acceptable starches (e.g. corn, potato or tapioca starch), sugars, artificial sweetening agents, powdered celluloses, such as crystalline and microcrystalline celluloses, flours, gelatins, gums, etc. Useful tablet formulations may be made by conventional compression, wet granulation or dry granulation methods and utilize pharmaceutically acceptable diluents, binding agents, lubricants, disintegrants, suspending or stabilizing agents, including, but not limited to, magnesium stearate, stearic acid, talc, sodium lauryl sulfate, microcrystalline cellulose, carboxymethyl-cellulose calcium, polyvinylpyrrolidone, gelatin, alginic acid, acacia gum, xanthan gum, sodium citrate, complex silicates, calcium carbonate, glycine, dextrin, sucrose, sorbitol, dicalcium phosphate, calcium sulfate, lactose, kaolin, mannitol, sodium chloride, talc, dry starches and powdered sugar. Oral formulations herein may utilize standard delay or time release formulations to alter the absorption of the active compound(s).

In some cases it may be desirable to administer the compounds directly to the airways in the form of an aerosol.

The compounds of this invention may also be administered parenterally or intraperitoneally. Solutions or suspensions of these active compounds as a free base or pharmacologically acceptable salt can be prepared in water suitably mixed with a surfactant such as hydroxy-propylcellulose. Dispersions can also be prepared in glycerol, liquid polyethylene glycols and mixtures thereof in oils. Under ordinary conditions of storage and use, these preparation contain a preservative to prevent the growth of microorganisms.

The pharmaceutical forms suitable for injectable use include sterile aqueous solutions or dispersions and sterile powders for the extemporaneous preparation of sterile injectable solutions or dispersions. In all cases, the form must be sterile and must be fluid to the extent that easy syringability exists. It must be stable under the conditions of manufacture and storage and must be preserved against the contaminating action of microorganisms such as bacteria and fungi. The carrier can be a solvent or dispersion medium containing, for example,

water, ethanol, polyol (e.g., glycerol, propylene glycol and liquid polyethylene glycol), suitable mixtures thereof, and vegetable oils.

Suppository formulations may be made from traditional materials, including cocoa
5 butter, with or without the addition of waxes to alter the suppository's melting point, and glycerin. Water soluble suppository bases, such as polyethylene glycols of various molecular weights, may also be used.

The compounds of the present invention also possess utility for increasing lean meat
10 deposition and/or improving lean meat to fat ratio in edible animals, i.e. ungulate animals and poultry.

Animal feed compositions effective for increasing lean meat deposition and for
improving lean meat to fat ratio in poultry, swine, sheep, goats, and cattle are generally
15 prepared by mixing the compounds of the present invention with a sufficient amount of animal feed to provide from about 1 to 1000 ppm of the compound in the feed. Animal feed supplements can be prepared by admixing about 75% to 95% by weight of a compound of the present invention with about 5% to about 25% by weight of a suitable carrier or diluent. Carriers suitable for use to make up the feed supplement compositions include the following:
20 alfalfa meal, soybean meal, cottonseed oil meal, linseed oil meal, sodium chloride, cornmeal, cane molasses, urea, bone meal, corncob meal and the like. The carrier promotes a uniform distribution of the active ingredients in the finished feed into which the supplement is blended. It thus performs an important function by ensuring proper distribution of the active ingredient throughout the feed. The supplement is used as a top dressing for the feed, it likewise helps to
25 ensure uniformity of distribution of the active material across the top of the dressed feed.

The preferred medicated swine, cattle, sheep and goat feed generally contain from 0.01
to 400 grams of active ingredient per ton of feed, the optimum amount for these animals
usually being about 50 to 300 grams per ton of feed. The preferred poultry and domestic pet
30 feed usually contain about 0.01 to 400 grams and preferably 10 to 400 grams of active ingredient per ton of feed.

For parenteral administration the compounds of the present invention may be prepared
in the form of a paste or a pellet and administered as an implant, usually under the skin of the
35 head or ear of the animal in which increase in lean meat deposition and improvement in lean meat to fat ratio is sought. In general, parenteral administration involves injection of a

sufficient amount of the compounds of the present invention to provide the animal with 0.001 to 100 mg/kg/day of body weight of the active ingredient. The preferred dosage for swine, cattle, sheep and goats is in the range of from 0.001 to 50 mg/kg/day of body weight of active ingredient; whereas, the preferred dose level for poultry and domestic pets is usually in the range of from 0.001 to 35 mg/kg/day of body weight.

Paste formulations can be prepared by dispersing the active compounds in a pharmaceutically acceptable oil such as peanut oil, sesame oil, corn oil or the like. Pellets containing an effective amount of the compounds of the present invention can be prepared by admixing the compounds of the present invention with a diluent such as carbowax, carnuba wax, and the like, and a lubricant, such as magnesium or calcium stearate, can be added to improve the pelleting process. It is, of course, recognized that more than one pellet may be administered to an animal to achieve the desired dose level which will provide the increase in lean meat deposition and improvement in lean meat to fat ratio desired. Moreover, it has been found that implants may also be made periodically during the animal treatment period in order to maintain the proper drug level in the animal's body. For the poultry and swine raisers, using the method of the present invention yields leaner animals.

Additionally, the compounds of this invention are useful in increasing the lean mass to fat ratio in domestic pets, for the pet owner or veterinarian who wishes to increase leanness and trim unwanted fat from pet animals, the present invention provides the means by which this can be accomplished.

The following procedures describe the preparation of representative compounds of this invention.

EXAMPLE 1

(1R)-2-Amino-1-(3-chloro-phenyl)-ethanol hydrochloride

Lithium azide (7.5 g, 150 mmol) was added to a solution of (1R)-1-(3-chloro-phenyl)oxirane (15.5 g, 100 mmol) in hexamethylphosphoramide(HMPA) (70 mL). After being stirred at room temperature for 16 hours the suspension was poured into ice-water and the mixture was extracted with diethyl ether. The combined extracts were dried over magnesium sulfate (MgSO₄) and concentrated. The residue was dissolved in 550 mL of tetrahydrofuran(THF)/water(H₂O) (10 : 1) and triphenylphosphine(30 g, 114 mmol) was added. After overnight stirring at room temperature, the solvents were removed and the residue was

purified by column chromatography on silica gel using triethylamine-methanol-methylene chloride(CH_2Cl_2) (1 : 1 : 8) as the eluent to give the title compound as a free base.

The title compound was characterized as its hydrochloric salt: The free base from
5 above was then dissolved in diethyl ether and slowly treated with hydrogen chloride gas. The precipitate was collected by filtration to yield 15 g (72%) of the title compound as a white powder; ^1H NMR (300 MHz, DMSO-d_6) δ 2.83 (dd, $J = 12.8, 9.5$ Hz, 1 H), 3.06 (dd, $J = 12.8, 3.2$ Hz, 1 H), 4.80-4.90 (m, 1 H), 6.22 (d, $J = 4.0$ Hz, 1 H), 7.10-7.75 (m, 4 H), 8.08 (brs, 2 H); MS (ES) m/z : 171.7, 173.7 (MH^+); HRMS Calcd. for $\text{C}_8\text{H}_{10}\text{ClNO}(\text{MH}^+)$: 172.0529. Found:
10 172.0531.

EXAMPLE 2

(2S)-2-Phenoxymethyl-oxirane

A solution of phenol (9.4 g, 100 mmol) and (2S)-(+)-glycidyl 3-nitrobenzenesulfonate
15 (25.9 g, 100 mmol) in 500 mL of acetone was treated with 3 equivalents of potassium carbonate (41.5 g, 300 mmol) and stirred at reflux for 1 day. The suspension was cooled to ambient temperature; the solid was filtered; and the filtrate was concentrated to dryness. The residue was partitioned between methylene chloride and water. The aqueous layer was extracted with CH_2Cl_2 . The organic layers were combined and dried over MgSO_4 and
20 concentrated to give the title compound (15.0 g, 99%) as an orange oil; ^1H NMR (300 MHz, CDCl_3) δ 2.76 (dd, $J = 4.9, 2.6$ Hz, 1 H), 2.90 (dd, $J = 4.9, 4.9$ Hz, 1 H), 3.30-3.40 (m, 1 H), 3.95 (dd, $J = 11.0, 5.4$ Hz, 1 H), 4.18 (dd, $J = 11.0, 3.0$ Hz, 1 H), 6.85-7.00 (m, 3 H), 7.25-7.35 (m, 2 H); MS (ES) m/z : 151.0 (MH^+).

EXAMPLE 3

(2S)-1-Amino-3-phenoxypropan-2-ol

The title compound was prepared from (2S)-2-phenoxyethyl-oxirane (which was obtained in Example 2) according to the procedure of Example 1 with one change. The free base was obtained as a white solid; ^1H NMR (300 MHz, DMSO-d_6) δ 2.56 (dd, $J = 12.8, 6.3$
30 Hz, 1 H), 2.67 (dd, $J = 12.8, 4.9$ Hz, 1 H), 3.65-3.75 (m, 1 H), 3.82 (dd, $J = 9.8, 6.0$ Hz, 1 H), 3.93 (dd, $J = 9.8, 5.0$ Hz, 1 H), 6.85-6.95 (m, 3 H), 7.20-7.30 (m, 2 H); MS (ES) m/z : 167.7 (MH^+); HRMS Calcd. for $\text{C}_9\text{H}_{13}\text{NO}_2(\text{M}^+)$: 167.0946. Found: 167.0945.

EXAMPLE 4(2S)-1-Amino-3-(4-benzyloxy-phenoxy)-propan-2-ol

The title compound was prepared from (2S)-2-(4-benzyloxy-phenoxy)methyl-oxirane (EP 0 714 883) according to the procedure of Example 1 with one change. The free base was obtained as a white solid; ¹H NMR (300 MHz, CDCl₃) δ 2.50-2.70 (m, 2 H), 3.33 (brs, 2 H), 3.60-3.90 (m, 3 H), 5.02 (s, 2 H), 6.90 (d, J = 6.7 Hz, 2 H), 6.93 (d, J = 6.7 Hz, 2 H), 7.25-7.50 (m, 5 H); MS (ES) m/z: 274.1 (MH⁺); HRMS Calcd. for C₁₆H₁₉NO₃(M⁺): 273.1365. Found: 273.1347. Anal. Calcd. for C₁₆H₁₉NO₃: C, 70.31; H, 7.01; N, 5.12. Found: C, 70.39; H, 6.80; N, 5.23.

EXAMPLE 5(2S)-1-Amino-3-(4-hydroxy-phenoxy)-propan-2-ol

A mixture of (2S)-1-amino-3-(4-benzyloxy-phenoxy)-propan-2-ol (0.9 g, 3.3 mmol) (which was obtained in Example 4), 0.2 mL of acetic acid and 10% palladium on carbon (Pd/C) (0.3 g) in 70 mL of ethanol was pressurized with 20 psi hydrogen and shaken over 2 hours. The catalyst was then removed by filtering through a short pad of silica gel and the solvent was removed to give the title compound as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.86 (s, 1 H), 2.66 (dd, J = 12.8, 5.3 Hz, 1H), 2.85 (dd, J = 12.8, 3.5 Hz, 1H), 3.79-3.95 (m, 3 H), 6.67 (d, J = 6.6 Hz, 2H), 6.75 (d, J = 6.6 Hz, 2 H); MS (ES) m/z: 183.1 (MH⁺); HRMS Calcd. for C₉H₁₃NO₃(MH⁺): 183.0895. Found: 183.0892.

EXAMPLE 6N-[2-Benzyloxy-5-(2-dibenzylamino-1-oxo-ethyl)-phenyl]-methanesulfonamide

N-[2-Benzyloxy-5-(2-chloro-1-oxo-ethyl)-phenyl]-methanesulfonamide (EP 0 659 737) (17.0 g, 42.8 mmol) was dissolved in 200 mL of N,N-dimethylformamide(DMF) and treated with dibenzylamine (22.0 g, 110 mmol). The mixture was stirred at room temperature overnight and then the solvent was removed. The residue was purified by silica gel chromatography using 20-50% ethyl acetate/hexanes as eluent to give the title compound as a white solid; ¹H NMR (300 MHz, CDCl₃) δ 2.94 (s, 3 H), 3.77 (s, 2 H), 3.82 (s, 2 H), 5.16 (s, 2 H), 6.75 (brs, 1 H), 6.96 (d, J = 8.7 Hz, 1 H), 7.20-7.50 (m, 15 H), 7.67 (dd, J = 8.7, 2.1 Hz, 1 H), 8.10 (d, J = 2.1 Hz, 1 H); MS (ES) m/z: 515.2 (MH⁺); HRMS Calcd. for C₃₀H₃₀N₂O₄S(M⁺): 514.1926. Found: 514.1927.

EXAMPLE 7N-[2-Benzyloxy-5-(2-dibenzylamino-1-hydroxy-ethyl)-phenyl]-methanesulfonamide

Sodium borohydride (0.37 g, 9.7 mmol) was added in portions to a stirred solution of N-[2-benzyloxy-5-(2-dibenzylamino-1-oxo-ethyl)-phenyl]-methanesulfonamide (1.0 g, 1.9 mmol) (which was obtained in Example 6) in 20 mL of methanol/THF (5 : 2) at room temperature and the resulting solution was stirred for 2 hours. Methylene chloride was added and the resulting solution was washed with aqueous sodium bicarbonate, dried over MgSO₄ and the solvents were removed. Recrystallization from methylene chloride/hexanes gave the title compound as a crystalline solid; ¹H NMR (300 MHz, CDCl₃) δ 2.58 (d, J = 6.7 Hz, 2 H), 2.86 (s, 2 H), 2.92 (s, 2 H), 3.55 (d, J = 13.5 Hz, 2 H), 3.70 (d, J = 13.5 Hz, 2 H), 4.11 (s, 1 H), 4.64 (t, J = 6.7 Hz, 1 H), 5.10 (s, 2 H), 6.92 (d, J = 8.5 Hz, 1 H), 7.00 (dd, J = 8.5, 2.0 Hz, 1 H), 7.20-7.50 (m, 16 H), 7.89 (brs, 1 H); MS (ES) m/z: 517.1 (MH⁺); HRMS Calcd. for C₃₀H₃₂N₂O₄S(M⁺): 516.2083. Found: 516.2074.

EXAMPLE 8N-[2-Benzyloxy-5-(2-amino-(1R)-1-hydroxy-ethyl)-phenyl]-methanesulfonamide

A mixture of N-{2-benzyloxy-5-(2-iodo-(1R)-1-[(triethylsilyl)oxy]-ethyl)-phenyl}-methanesulfonamide (EP 0 659 737) (4.48 g, 8 mmol) and sodium azide (0.65 g, 10 mmol) in 100 mL of HMPA was stirred at 60°C overnight. After cooling to room temperature the mixture was diluted with diethyl ether, washed with water, dried over sodium sulfate(Na₂SO₄) and concentrated under reduced pressure. The residue was dissolved in 200 mL of THF/H₂O (10 : 1) and triphenylphosphine (2.62 g, 10 mmol) was added. After overnight stirring at room temperature, the solvents were removed and the residue was partitioned between ethyl acetate and water. The organic layers were combined and dried over MgSO₄ and concentrated. The residue was redissolved in 100 mL of THF and tetrabutylammonium fluoride(TBAF) (10 mL, 1 M solution in THF) was added. The reaction was stirred for 2 hours then the solvent was removed in vacuo. The residue was purified by column chromatography on silica gel using triethylamine-methanol-CH₂Cl₂ (1:1:3) to give the title compound as a white solid; MS (ES) m/z: 337.4 (MH⁺).

EXAMPLE 9N-[5-(2-Amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide

To a stirred suspension of N-[2-benzyloxy-5-(2-dibenzylamino-1-hydroxy-ethyl)-phenyl]-methanesulfonamide (1.03g, 2 mmol) (which was obtained in Example 7) and 10% palladium

on carbon (Pd/C)(0.4 g) in methanol (100 mL) at room temperature was added anhydrous ammonium formate (HCO_2NH_4)(1.26 g, 20 mmol) under a nitrogen atmosphere. The resulting mixture was refluxed for 2 hours. After cooling to room temperature the catalyst was removed by filtration through a celite pad and washed with methanol. The filtrate is evaporated under reduced pressure to give the titled compound (Leclerc, G., Bizec, J. C. *J. Med. Chem.*, **1980**, 23, 738) as a pale yellowish solid; ^1H NMR (300 MHz, DMSO-d_6) δ 2.62 (dd, $J = 12.6, 8.7$ Hz, 1 H), 2.75 (dd, $J = 12.6, 3.7$ Hz, 1 H), 2.90 (s, 3 H), 4.47 (dd, $J = 8.7, 3.7$ Hz, 1 H), 6.84 (d, $J = 9.1$ Hz, 1 H), 6.96 (dd, $J = 9.1, 2.0$ Hz, 1 H), 7.16 (d, $J = 2.1$ Hz, 1 H), 8.44 (s, 1 H); MS (ES) m/z : 246.7 (MH^+); HRMS Calcd. for $\text{C}_9\text{H}_{14}\text{N}_2\text{O}_4\text{S}(\text{M}^+)$: 246.0674. Found: 246.0672.

EXAMPLE 10

N-[5-(2-Amino-(1R)-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide

Method A: A mixture of N-{2-benzyloxy-5-(2-iodo-(1R)-1-[(triethylsilyl)oxy]-ethyl)-phenyl}-methanesulfonamide (EP 0 659 737) (8.60 g, 15.3 mmol) and benzylamine (21.4 g, 200 mmol) was heated at 60°C for 24 hours. The reaction mixture was cooled, diluted with hexanes (500 mL), and the residue was washed with diethyl ether. The combined solvents were removed and the residue was purified by silica gel column eluting with 30 to 100% diethyl ether/hexanes. The fractions with molecular weight of 540 were concentrated and re-dissolved in 200 mL of THF and TBAF (20 mL, 1.0 M solution in THF) was added. After stirring at room temperature for 4 hours the reaction mixture was then poured into water and extracted with CH_2Cl_2 . The organic layers were passed through a short pad of silica gel eluting with 10% methanol/ CH_2Cl_2 . The solvents were removed and the residue was dissolved in methanol (200 mL). 10% Pd/C (0.6 g) and anhydrous HCO_2NH_4 (6.3 g, 100 mmol) were added. The resulting mixture was refluxed under a nitrogen atmosphere for 2 hours. After cooling to room temperature the catalyst was removed by filtration through a celite pad and washed with methanol. The filtrate was evaporated under reduced pressure to give the title compound as an off-white solid; ^1H NMR (300 MHz, MeOH-d_4) δ 2.95 (s, 3 H), 2.99 (dd, $J = 9.7, 9.2$ Hz, 1 H), 3.07 (dd, $J = 9.7, 3.6$ Hz, 1 H), 4.75 (dd, $J = 9.2, 3.6$ Hz, 1 H), 6.90 (d, $J = 8.3$ Hz, 1 H), 7.12 (dd, $J = 8.3, 2.1$ Hz, 1 H), 7.38 (d, $J = 2.1$ Hz, 1 H), 8.44 (s, 1 H); MS (ES) m/z : 246.7 (MH^+); HRMS Calcd. for $\text{C}_9\text{H}_{14}\text{N}_2\text{O}_4\text{S}$: 246.0674. Found: 246.0672.

Method B: To a stirred solution of N-[2-benzyloxy-5-(2-bromo-1-hydroxy-ethyl)-phenyl]-methanesulfonamide (EP 0 659 737) (15.05 g, 0.376 mol) in dimethyl sulfoxide (300 MHz, DMSO-d_6) (150 mL) was added sodium iodide (3.76 g, 0.376 mol) and sodium azide (9.48 g,

0.150 mol). The mixture was stirred for 5 days under nitrogen atmosphere. The reaction mixture was poured onto water and extracted three times with ethyl acetate. The combined organic layers were dried over sodium sulfate and concentrated. The residue was triturated with water and hexanes. Recovered yellow solid as of N-[5-((1R)-2-azido-1-hydroxy-ethyl)-2-benzyloxy-phenyl]-methanesulfonamide (12.85 g, 94%); ¹H NMR (300 MHz, CDCl₃) δ 2.93(s, 3 H), 3.45(d, J = 9.0 Hz, 2 H), 3.46(m, 1 H), 5.11(s, 2 H), 6.80(s, 1 H), 6.99(d, J = 8.4 Hz, 1 H), 7.15(dd, J = 6 Hz, 2.1 Hz, 1H), 7.26(s, 1 H), 7.39(s, 5 H), 7.53(d, J = 2.1 Hz, 1 H); MS (ES) m/z: 361.4 ((M-H)⁻, 70%). A mixture of N-[5-((1R)-2-azido-1-hydroxy-ethyl)-2-benzyloxy-phenyl]-methanesulfonamide (12.85 g, 0.037 mol) and 10% Pd/C (2.75 g) in ethanol (100 mL) was hydrogenated under 45 psi for two days. The reaction mixture was filtered through celite and concentrated. The title compound was recovered as a tan solid. The product was found to be identical with that prepared by method A.

EXAMPLE 11

8-Benzyloxy-(5S)-5-oxiranylmethoxy-3,4-dihydro-1H-quinolin-2-one

The title compound was prepared from 8-benzyloxy-5-hydroxy-3,4-dihydro-1H-quinolin-2-one (Tominaga, M., Ogawa, H., Yo, E., Yamashita, S., Yabuuchi, Y., Nakagawa, K. *Chem. Pharm. Bull.* **1987**, *35*, 3699) according to the procedure of Example 2; ¹H NMR (300 MHz, DMSO-d₆) δ 2.41 (t, J = 7.1 Hz, 2 H), 2.69 (dd, J = 5.1, 2.7 Hz, 1 H), 2.75-2.86 (m, 4 H), 3.78 (dd, J = 11.4, 6.3 Hz, 1 H), 4.23 (dd, J = 11.4, 2.6 Hz, 1 H), 5.09 (s, 2 H), 6.54 (d, J = 9.0 Hz, 2 H), 6.86 (d, J = 9.0 Hz, 2 H), 7.25-7.45 (m, 3 H), 7.51 (d, J = 8.2 Hz, 2 H), 9.08 (s, 1 H); MS (ES) m/z: 326.0 (MH⁺); HRMS Calcd. for C₁₉H₂₀NO₄(MH⁺): 326.1392. Found: 326.1343. Anal. Calcd. for C₁₉H₁₉NO₄: C, 70.14; H, 5.89; N, 4.30. Found: C, 70.14; H, 5.69; N, 4.20.

EXAMPLE 12

5-(3-Amino-(2S)-2-hydroxy-propoxy)-8-hydroxy-3,4-dihydro-1H-quinolin-2-one

Dibenzylamine (1.46g, 7.4 mmol) was added to a stirred solution of 8-benzyloxy-(5S)-5-oxiranylmethoxy-3,4-dihydro-1H-quinolin-2-one (which was obtained in Example 11) (2.0 g, 6.2 mmol) in 100 mL of methanol. After refluxing overnight the mixture was cooled down to room temperature and 10% Pd/C (0.5 g) and HCO₂NH₄ (3.15g, 50 mmol) were added. The suspension was refluxed for another hour. After cooling the suspension the reaction mixture was filtered through celite. The filtrate was concentrated to give the title compound as a pale grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.42(t, J = 7.1 Hz, 2 H), 2.74 (dd, J = 12.8, 8.2 Hz, 1 H), 2.81 (t, J = 7.0 Hz, 2 H), 2.95 (dd, J = 12.8, 3.4 Hz, 1 H), 3.65-3.95 (m, 3 H), 6.45 (d, J =

8.8 Hz, 2 H), 6.62 (d, $J = 8.8$ Hz, 2 H), 8.38 (s, 1 H), 8.77 (brs, 1 H); MS (ES) m/z : 252.9 (MH^+); HRMS Calcd. for $C_{12}H_{16}N_2O_4(M^+)$: 252.1188. Found: 252.1199.

EXAMPLE 13

5 N-Benzyl-N-(2-benzyloxy-5-oxiranylmethoxy-phenyl)-methanesulfonamide

The title compound was prepared from N-benzyl-N-(2-benzyloxy-5-hydroxy-phenyl)-methanesulfonamide(Kaiser, C.; Jen, T.; Garvey, E.; and Bowen, W. D. *J. Med. Chem.* **1977**, *20*, 687) according to the procedure of Example 2 as a white solid; 1H NMR (300 MHz, DMSO- d_6) δ 2.63(dd, $J = 5.1, 2.6$ Hz, 1 H), 2.80(t, $J = 4.9$ Hz, 1 H), 3.10-3.20(m, 1 H), 3.66(dd, $J =$
10 11.4, 6.6 Hz, 1 H), 4.16(dd, $J = 11.4, 2.6$ Hz, 1 H), 4.73(brs, 2 H), 5.12(s, 2 H), 6.69 (d, $J = 3.1$ Hz, 1 H), 6.88(dd, $J = 9.1, 3.1$ Hz, 1 H), 7.08 (d, $J = 9.1$ Hz, 1 H), 7.15-7.60(m, 10 H); MS (ES) m/z : 439.9 (MH^+ , 100%); HRMS Calcd. for $C_{24}H_{25}NO_5S(M^+)$: 439.1454. Found: 439.1457.

EXAMPLE 14

15 N-[5-((2S)-3-Amino-2-hydroxy-propoxy)-2-hydroxy-phenyl]-methanesulfonamide

The title compound was prepared from N-benzyl-N-(2-benzyloxy-5-oxiranylmethoxy-phenyl)-methanesulfonamide(which was obtained in Example 13) according to the procedure of Example 12 as a pale grey solid; 1H NMR (300 MHz, DMSO- d_6) δ 2.61(dd, $J = 12.7, 6.1$ Hz, 1 H), 2.75(dd, $J = 12.7, 3.5$ Hz, 1 H), 2.86(s, 3 H), 3.69-3.90(m, 3 H), 6.55(dd, $J = 8.7, 3.1$ Hz,
20 1 H),6.70(d, $J = 8.7$ Hz, 1 H), 6.75 (d, $J = 3.1$ Hz, 1 H); MS (ES) m/z : 276.8 (MH^+ , 100%); HRMS Calcd. for $C_{10}H_{16}N_2O_5S(M^+)$: 276.0780. Found: 276.0792.

EXAMPLE 15

Benzoic acid 4-benzyloxy-3-nitro-phenyl ester

25 A mixture of benzoic acid 4-hydroxy-3-nitro-phenyl ester (Tapia, R.; Torres, G. and Valderrama, J. A. *Synth. Commun.* **1986**, *16*, 681)(20.7g, 80 mmol), benzyl bromide (42.75 g, 250 mmol), potassium carbonate (48.3 g, 350 mmol) and DMF(300 mL) was stirred at room temperature for 2 days. After removing the solvent the residue was dissolved in water and extracted with CH_2Cl_2 . The organic extracts were dried ($MgSO_4$) and concentrated. The
30 product was purified by flash silica gel chromatography eluting with CH_2Cl_2 to give the title compound as a pale yellowish solid (25.1 g, 90%); 1H NMR (300 MHz, $CDCl_3$) δ 5.27(s, 2 H), 7.17(d, $J = 9.1$ Hz, 1 H), 7.30-7.55(m, 8 H), 7.60-7.70(m, 1 H), 7.80(d, $J = 2.9$ Hz, 1 H), 8.15-8.25(m, 2 H); MS (ES) m/z : 345.0 (MH^+ , 100%); HRMS Calcd. for $C_{20}H_{15}NO_5(M^+)$: 349.0951. Found: 349.0952.

EXAMPLE 16**Benzoic acid 3-amino-4-benzyloxy-phenyl ester**

A Parr hydrogenator was charged with platinum(IV) oxide(PtO₂)(0.3 g) and a solution of benzoic acid 4-benzyloxy-3-nitro-phenyl ester(5.23g, 15 mmol) (which was obtained in Example 15) in methanol (80 mL) and CH₂Cl₂(40 mL). This mixture was then hydrogenated at 5 psi of hydrogen at 0~10 °C for 2 hours. The reaction mixture was filtered through a short pad of celite and concentrated. Recrystallization from CH₂Cl₂/hexanes gave the title compound as a white solid (3.80 g, 79%); ¹H NMR (300 MHz, CDCl₃) δ 5.09(s, 2 H), 6.57(dd, J = 10.1, 2.7 Hz, 1 H), 7.10(d, J = 2.7 Hz, 1 H), 7.30-7.50(m, 8 H), 7.55-7.65(m, 1 H), 8.15-8.25(m, 2 H); MS (ES) m/z: 320.0 (MH⁺, 100%); HRMS Calcd. for C₂₀H₁₈NO₃ (MH⁺): 320.1281. Found: 320.1278.

EXAMPLE 17**Benzoic acid 3-benzenesulfonylamino-4-benzyloxy-phenyl ester**

To a stirred solution of benzoic acid 3-amino-4-benzyloxy-phenyl ester (5.91 g, 18.5 mmol) (which was obtained in Example 16) in ethyl acetate (100 mL) and pyridine (20 mL) at 0°C was added dropwise phenyl sulfonyl chloride (3.26 g, 18.5 mmol) in 50 mL of ethyl acetate. After one hour at 0 °C the mixture was warmed to room temperature and stirred at room temperature over night. The reaction mixture was washed with water and the organic layer was dried (MgSO₄) and concentrated. Recrystallization from CH₂Cl₂/hexanes gave the title compound as a white solid (4.65 g, 61%); ¹H NMR (300 MHz, CDCl₃) δ 4.93(s, 2 H), 6.90-7.80(m, 15 H), 8.12(d, J = 8.5 Hz, 2 H), 9.81(s, 1 H); MS (ES) m/z: 458.9 (MH⁺, 100%); HRMS Calcd. for C₂₆H₂₂NO₅S(MH⁺): 459.1141. Found: 459.1151.

EXAMPLE 18**Benzoic acid 3-(benzenesulfonyl-benzyl-amino)-4-benzyloxy-phenyl ester**

To a stirred solution of benzoic acid 3-benzenesulfonylamino-4-benzyloxy-phenyl ester(which was obtained in Example 17) (2.88 g, 7.27 mmol) in DMF(20 mL) was added 60% sodium hydride (0.32 g, 8 mmol). After hydrogen evolution had subsided the stirred mixture was heated at 70 °C for 15 minute, and then it was cooled down to room temperature and a solution of benzyl chloride (1.01 g, 8 mmol) in 5 mL of DMF was added dropwise. The mixture was then heated at 85 - 90 °C for 2 hours, then it was cooled down to room temperature, poured into ice-water. The aqueous layer was extracted with ethyl acetate and the organic

layer was dried and concentrated. The product was purified by flash silica gel chromatography eluting with ethyl acetate and hexanes to give the title compound as a white solid (2.40 g, 70%); ^1H NMR (300 MHz, CDCl_3) δ 4.74(s, 2 H), 4.83(s, 2 H), 8.83(d, J = 8.9 Hz, 1 H), 8.10-8.50(m, 2 H); HRMS Calcd. for $\text{C}_{33}\text{H}_{28}\text{NO}_5\text{S}(\text{MH}^+)$: 550.1688. Found: 550.1680.

5

EXAMPLE 19N-Benzyl-N-(2-benzyloxy-5-hydroxy-phenyl)-benzenesulfonamide

To a stirred solution of benzoic acid 3-(benzenesulfonyl-benzyl-amino)-4-benzyloxy-phenyl ester(which was obtained in Example 18) (1.80 g, 3.28 mmol) in THF(10 mL) and methanol(10 mL) was added 10% of sodium hydroxide (10 mL). The mixture was stirred at room temperature for 1.5 hours, acidified with concentrated hydrochloric acid and diluted with water (200 mL). The aqueous solution was extracted with CH_2Cl_2 . The organic phase was dried over MgSO_4 and concentrated. The product was purified by flash silica gel chromatography eluting with ethyl acetate and hexanes to give the title compound as a white solid (1.20 g, 82%); ^1H NMR (300 MHz, CDCl_3) δ 4.71(brs, 4 H), 6.49(d, J = 3.0 Hz, 1 H), 6.62(dd, J = 9.0, 3.0 Hz, 1 H), 6.84(d, J = 9.0 Hz, 1 H), 7.10-7.70(m, 15 H), 9.07(brs, 1 H); MS (ES) m/z : 444.0 ((M-H) $^-$, 100%); HRMS Calcd. for $\text{C}_{26}\text{H}_{22}\text{NO}_4\text{S}(\text{M-H})^-$: 444.1275. Found: 444.1270.

EXAMPLE 20N-Benzyl-N-(2-benzyloxy-5-oxiranylmethoxy-phenyl)-benzenesulfonamide

The title compound was prepared from N-benzyl-N-(2-benzyloxy-5-hydroxy-phenyl)-benzenesulfonamide (which was obtained in Example 19) according to the procedure of Example 2 as a white solid; ^1H NMR (300 MHz, CDCl_3) δ 2.68(dd, J = 4.9, 2.7 Hz, 1 H), 2.85(t, J = 4.7 Hz, 1 H), 3.20-3.30(m, 1 H), 3.76(dd, J = 11.0, 5.7 Hz, 1 H), 4.05(dd, J = 11.0, 3.1 Hz, 1 H), 4.65(s, 2 H), 4.81(brs, 2 H), 6.65-6.80(m, 3 H), 7.05-7.15(m, 2 H), 7.15-7.50(m, 11 H), 7.65-7.75(m, 2 H); HRMS Calcd. for $\text{C}_{29}\text{H}_{28}\text{NO}_5\text{S}(\text{MH}^+)$: 502.1689. Found: 502.1675.

EXAMPLE 21N-[5-(3-Amino-2-hydroxy-propoxy)-2-hydroxy-phenyl]-benzenesulfonamide

The title compound was prepared from N-benzyl-N-(2-benzyloxy-5-oxiranylmethoxy-phenyl)-benzenesulfonamide (which was obtained in Example 20) according to the procedure of Example 12 as a brown solid; ^1H NMR (300 MHz, CDCl_3) δ 3.40-4.20(m, 5 H), 6.40-7.00(m, 3 H), 7.10-7.60(m, 3 H), 7.60-7.80(m, 2 H), 8.15(brs, 1 H); MS (ES) m/z : 338.8 (MH^+ , 100%); HRMS Calcd. for $\text{C}_{15}\text{H}_{19}\text{N}_2\text{O}_5\text{S}(\text{MH}^+)$: 339.1009. Found: 339.1004.

EXAMPLE 22**5-Acetyl-2-chloro-phenylaniline**

To a stirred solution of 4-chloro-3-nitroacetophenone (10 g, 50 mmol) in concentrated hydrochloric acid (150 mL) was added tin chloride dihydrate (33.8 g, 150 mmol). The mixture was stirred at room temperature for one day, basified with 28% of ammonium hydroxide and diluted with water (1 L). The aqueous solution was extracted with methylene chloride. The organic phase was dried over MgSO_4 and concentrated. Recrystallization from CH_2Cl_2 /hexanes gave the title compound as a yellowish crystal (7.0 g, 83%); ^1H NMR (300 MHz, CDCl_3) δ 2.55(s, 3 H), 4.19(brs, 2 H), 7.22-7.38(m, 3 H); MS (ES) m/z: 169.8 (MH^+ , 100%); HRMS Calcd. for $\text{C}_8\text{H}_9\text{ClNO}(\text{MH}^+)$: 170.3667. Found: 170.0368.

EXAMPLE 23**N-(5-Acetyl-2-chloro-phenyl)-methanesulfonamide**

To a stirred solution of 5-acetyl-2-chloro-phenylaniline (which was obtained in Example 22)(7.40 g, 43.5 mmol) in CH_2Cl_2 (200 mL) and pyridine (40 mL) at 0~5 °C was added dropwise methanesulfonyl chloride (5.0 g, 43.6 mmol) in 50 mL of CH_2Cl_2 . After 1 hour at 0 °C the mixture was warmed to room temperature and stirred at room temperature for another hour. The solvents were removed and the residue was dissolved in CH_2Cl_2 (500 mL). The reaction mixture was washed with water and the organic layer was dried (MgSO_4) and concentrated. The product was purified by flash silica gel chromatography eluting with ethyl acetate and hexanes to give the title compound as a white solid (6.1 g, 57%); ^1H NMR (300 MHz, $\text{DMSO}-d_6$) δ 2.58(s, 3 H), 3.08(s, 3 H), 7.69(d, J = 8.3 Hz, 1 H), 7.83(dd, J = 8.3, 2.1 Hz, 1 H), 7.94(d, J = 2.1 Hz, 1 H), 9.69(s, 1 H); MS (ES) m/z: 245.9 ($(\text{M}-\text{H})^-$, 100%); HRMS Calcd. for $\text{C}_9\text{H}_{11}\text{ClNO}_3\text{S}(\text{MH}^+)$: 248.0148. Found: 248.0135.

EXAMPLE 24**N-(5-Bromoacetyl-2-chloro-phenyl)-methanesulfonamide**

A mixture of N-(5-acetyl-2-chloro-phenyl)-methanesulfonamide (2.47 g, 10 mmol) (which was obtained in Example 23) and copper(II) bromide (11.17g, 50 mmol) in chloroform (150 mL) was refluxed for 5 hours. After cooling down to room temperature the solid was filtered off and the solution was concentrated. Recrystallization from chloroform/diethyl ether gave the title compound as a white solid (3.10 g, 96%); ^1H NMR (300 MHz, CDCl_3) δ 3.09 (s, 3 H), 4.42(s, 2 H), 6.91(brs, 1 H), 7.58(d, J = 8.4 Hz, 1 H), 7.77(dd, J = 8.4, 2.1 Hz, 1 H), 8.24

(d, $J = 2.1$ Hz, 1 H); MS (ES) m/z : 323.7 ((M-H)⁻, 100%); HRMS Calcd. for C₉H₁₀BrClNO₃S(MH⁺): 325.9249. Found: 325.9245.

EXAMPLE 25

5 N-[5-((1R)-2-Azido-1-hydroxy-ethyl)-2-chloro-phenyl]-methanesulfonamide

R-2-Methyl-CBS-oxazaborolidine (1.0 M in THF, 2 mL, 2 mmol) in 50 mL of THF was added slowly to a stirred solution of borane-THF complex (1.0 M in THF, 12 mL, 12 mmol) at room temperature. The mixture was stirred for 30 minutes and then N-(5-bromoacetyl-2-chloro-phenyl)-methanesulfonamide (which was obtained in Example 24)(2.80 g, 8.6 mmol) in 50 mL of THF was added dropwise. Upon stirring over night hydrochloride (1.0 M solution in diethyl ether) was added until the pH was ~ 1. After stirring for one hour the reaction mixture was partitioned between ethyl acetate and water. The organic phase was dried over MgSO₄ and concentrated. The residue was then dissolved in 50 mL of DMSO. To the solution sodium azide (2.93 g, 45 mmol) and sodium iodide (3 g, 20 mmol) were added. After stirring at room temperature for 3 days the reaction was quenched with water, extracted with diethyl ether. The organic layer was dried over MgSO₄ and concentrated. The product was purified by flash silica gel chromatography eluting with ethyl acetate and hexanes to give the title compound as a white solid (1.6 g, 64%); ¹H NMR (300 MHz, CDCl₃) δ 2.60(d, $J = 5.9$ Hz, 1 H), 3.06(s, 3 H), 3.45-3.50(m, 2 H), 4.85-4.95(m, 1 H), 6.84(brs, 1 H), 7.22(dd, $J = 8.3, 2.0$ Hz, 1 H), 7.44(d, $J = 8.3$ Hz, 1 H), 7.65 (d, $J = 2.0$ Hz, 1 H); MS (ES) m/z : 288.9 ((M-H)⁻, 100%); HRMS Calcd. for C₉H₁₂ClN₄O₃S(M⁺): 290.0241. Found: 290.0228.

EXAMPLE 26

Propane-2-sulfonic acid (5-acetyl-2-benzyloxy-phenyl)-amide

25 To a stirred solution of 1-(3-amino-4-benzyloxy-phenyl)-ethanone (EP 0 659 737) (30g, 125.0 mmol) in CH₂Cl₂(500 mL) and pyridine (250 mL) was added dropwise isopropylsulfonyl chloride (28.6, 200 mmol) at room temperature. The reaction was stirred for 3 days under nitrogen atmosphere. The mixture was diluted with CH₂Cl₂(700 mL) and washed with 1N hydrochloric acid, water, dried over Na₂SO₄, and concentrated. The product was purified by flash silica gel chromatography eluting with ethyl acetate/hexanes to give the title compound as a white solid(13 g, 30%); ¹H NMR (300 MHz, CDCl₃) δ 1.35(d, $J = 6.9$ Hz, 6 H), 2.56(s, 3 H), 3.25-3.45(m, 1 H), 5.18(s, 2 H), 6.75(brs, 1 H), 7.02 (d, $J = 8.6$ Hz, 1 H), 7.30-7.50(m, 5 H), 7.70(dd, $J = 8.6, 2.1$ Hz, 1 H), 8.18 (d, $J = 2.1$ Hz, 1 H); MS (ES) m/z : 364.9 ((M+NH₄)⁺, 100%); HRMS Calcd. for C₁₈H₂₂NO₄S(MH⁺): 348.1264. Found: 348.1259.

EXAMPLE 27**Propane-2-sulfonic acid [5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-amide**

The title compound was prepared from propane-2-sulfonic acid (5-acetyl-2-benzyloxy-phenyl)-amide (which was obtained in Example 26) as described in the procedures of Example 25 and Example 10 as a white solid; ^1H NMR (300 MHz, DMSO- d_6) δ 1.26(d, J = 6.8 Hz, 6 H), 2.74 (dd, J = 12.6, 9.8 Hz, 1 H), 2.92 (dd, J = 12.6, 3.0 Hz, 1 H), 3.10-3.20(m, 1 H), 4.63 (dd, J = 9.8, 3.0 Hz, 1 H), 6.85(d, J = 8.3 Hz, 1 H), 7.01 (dd, J = 8.3, 2.1 Hz, 1 H), 7.27 (d, J = 2.1 Hz, 1 H); MS (ES) m/z: 274.8 (MH^+ , 100%); HRMS Calcd. for $\text{C}_{11}\text{H}_{18}\text{N}_2\text{O}_4\text{S}(\text{MH}^+)$: 274.0987. Found: 274.1004.

EXAMPLE 28**N-(5-Acetyl-2-benzyloxy-phenyl)-benzenesulfonamide**

To a stirred solution of 1-(3-amino-4-benzyloxy-phenyl)-ethanone (EP 0 659 737) (16.98g, 70.0 mmol) in pyridine (50 mL) was added dropwise benzenesulfonyl chloride (13.09g, 73.5 mmol) in 100 mL of pyridine at room temperature. The reaction was stirred for 18 hours under nitrogen atmosphere. The mixture was diluted with CH_2Cl_2 (700 mL) and washed with 1N hydrochloric acid, water, dried over Na_2SO_4 , and concentrated. The product was purified by flash silica gel chromatography eluting with CH_2Cl_2 to give the title compound as a tan solid (12.55g, 47%); ^1H NMR (300 MHz, DMSO- d_6) δ 3.33(s, 3 H), 5.03(s, 2 H), 7.02(d, J = 8.7 Hz, 1 H), 7.35(m, 3 H), 7.44(t, J = 15 Hz, 2 H), 7.58(m, 1 H), 7.50 (m, 3 H), 7.81(d, 1 H), 9.83(s, 1 H); MS (ES) m/z: 381.9 (MH^+ , 100%); HRMS Calcd. for $\text{C}_{21}\text{H}_{19}\text{NO}_4\text{S}(\text{MH}^+)$: 382.1107. Found: 382.1100.

EXAMPLE 29**N-(2-Benzyloxy-5-bromoacetyl-phenyl)-benzenesulfonamide**

A mixture of N-(5-acetyl-2-benzyloxy-phenyl)-benzenesulfonamide (which was obtained in Example 28) (1.0g, 2.6 mmol) and copper (II) bromide (0.99g, 4.4 mmol) in chloroform/ethyl acetate (45 mL) was refluxed under nitrogen atmosphere for 18 hours. Reaction mixture was filtered through celite and the filtrate was concentrated. Recrystallization from ethyl acetate gave the titled compound as a white solid (0.64g, 53%); ^1H NMR (300 MHz, DMSO- d_6) δ 4.79(s, 2 H), 5.06(s, 2 H), 7.05(m, 1 H), 7.33(m, 5 H), 7.43(t, J = 12 Hz, 2 H), 7.58(m, 1 H), 7.69(d, J = 3 Hz, 2 H), 7.86(m, 2 H) 9.89 (s, 1 H); MS (ES) m/z: 459.8 (MH^+ , 85%); HRMS Calcd. for $\text{C}_{21}\text{H}_{18}\text{BrNO}_4\text{S}(\text{MH}^+)$: 460.0213. Found: 460.0212.

EXAMPLE 30**N-(2-Benzyloxy-5-(2-bromo-1-hydroxy-ethyl-phenyl)-benzenesulfonamide**

R-2-Methyl-CBS-oxazaborolidine (1.0 M in THF, 0.54 mL, 0.54 mmol) was added slowly to a stirred solution of borane-THF complex (1.0 M in THF, 3.23 mL, 3.23 mmol) at room temperature. The mixture was stirred for an additional 20-30 minutes. N-(2-benzyloxy-5-bromoacetyl-phenyl)-benzenesulfonamide (which was obtained in Example 29) (2.48g, 5.4 mmol) in THF (40 mL) was added dropwise to the mixture. The reaction was stirred an additional 18 hours. The reaction was cooled to 0 °C and quenched with 1N hydrochloric acid. The mixture was stirred at 0 °C for one hour. The mixture was partitioned between water and ethyl acetate, dried over MgSO₄, and concentrated. The product was purified by flash silica gel chromatography eluting with 1% methanol in CH₂Cl₂ to give the titled compound (1.52 g, 61%); ¹H NMR (300 MHz, CDCl₃) δ 2.56 (d, J = 6 Hz, 1 H), 3.53 (m, 2 H), 4.86 (s, 2 H), 6.77 (d, J = 6 Hz, 1 H), 7.13 (m, 4 H), 7.35 (m, 4 H), 7.53 (m, 1 H), 7.59 (d, J = 2.1 Hz, 1 H), 7.69 (m, 2 H); MS (ES) m/z: 459.9 ((M-H)⁻, 100%); HRMS Calcd. for C₂₁H₂₀BrNO₄S(MH⁺): 462.0369. Found: 462.0366.

EXAMPLE 31**N-[5-((1R)-2-Azido-1-hydroxy-ethyl)-2-benzyloxy-phenyl]-benzenesulfonamide**

To a stirred solution of N-(2-benzyloxy-5-(2-bromo-1-hydroxy-ethyl-phenyl)-benzenesulfonamide (1.52g, 3.3 mmol) (which was obtained in Example 30) in dimethylsulfoxide under nitrogen atmosphere was added sodium iodide (0.5 g, 3.3 mmol) and sodium azide (0.86g, 13.2 mmol). The reaction was stirred for three days at room temperature. The reaction mixture was poured onto water, extracted with ethyl acetate three times, dried over magnesium sulfate, and concentrated to give the titled compound as an oil; ¹H NMR (300 MHz, CDCl₃) δ 3.43(m, 2 H), 4.79(m, 1 H), 4.86(s, 2 H), 6.76(d, J = 9 Hz, 1 H), 7.06(m, 2 H), 7.13(m, 2 H), 7.35(m, 4 H), 7.57(m, 2 H), 7.69(d, J = 9 Hz, 2 H).

EXAMPLE 32**N-[5-((1R)-2-Amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-benzenesulfonamide**

A mixture of N-[5-((1R)-2-azido-1-hydroxy-ethyl)-2-benzyloxy-phenyl]-benzenesulfonamide (1.4 g, 3.3 mmol) (which was obtained in Example 31), HCO₂NH₄ (2.08 g, 3.3 mmol), and 10% Pd/C in absolute ethanol (15 mL) under nitrogen atmosphere was heated under reflux for 2.5 hours. The mixture was cooled to room temperature, filtered through celite pad, and filtrate concentrated and placed under high vacuum to give the titled compound as

yellow solid (0.7 g, 69%); ^1H NMR (300 MHz, DMSO- d_6) δ 2.74(d, J = 15 Hz, 2 H), 4.51(d, J = 6 Hz, 1 H), 6.63(d, J = 9 Hz, 1 H), 6.76(d, J = 9 Hz, 1 H), 7.12(s, 1 H), 7.47(m, 4 H), 7.72(d, J = 6 Hz, 2 H).

5 EXAMPLE 33

5-[4(1,4-Dioxa-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-2-thioxothiazolidin-4-one

A mixture of 4-(1,4-dioxa-8-aza-spiro[4.5]dec-8-yl)-benzaldehyde (Taylor, E. C., Skotnicki, J. S. *Synthesis*, **1981**, 606) (4.96 g, 20 mol), rhodanine (2.66 g, 20 mmol), and β -alanine (2.0 g, 22.5 mmol) in 50 mL of acetic acid(AcOH) was refluxed for 2 hours. The solid
10 which was formed on cooling the solution was collected to give the title compound as a red solid (4.8 g, 66%); ^1H NMR (300 MHz, CDCl_3) δ 1.81 (t, J = 5.5 Hz, 4 H), 3.55 (t, J = 5.5 Hz, 4 H), 4.00 (s, 4 H), 6.92 (d, J = 8.9 Hz, 2 H), 7.58 (d, J = 8.9 Hz, 2 H), 7.38 (s, 1 H); MS (ES) m/z: 362.8 (MH^+); HRMS Calcd. for $\text{C}_{17}\text{H}_{19}\text{N}_2\text{O}_3\text{S}_2(\text{MH}^+)$: 363.0837. Found: 363.0852. Anal. Calcd. for $\text{C}_{17}\text{H}_{18}\text{N}_2\text{O}_3\text{S}_2$: C, 56.33; H, 5.01; N, 7.73. Found: C, 56.28; H, 4.89; N, 7.73.

15

EXAMPLE 34

1-[4-(4-Oxo-2-thioxo-thiazolidin-5-ylidenemethyl)-phenyl]-piperidin-4-one

5-[4(1,4-Dioxa-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-2-thioxothiazolidin-4-one (which was obtained in Example 33) (0.9 g, 2.5 mmol) was treated with concentrated hydrochloric acid (25mL) at room temperature. After 15 hours ~28% ammonium hydroxide (NH_4OH) was added
20 dropwise and the precipitate was collected by filtration, and dried over phosphorus pentoxide (P_2O_5) to give the title compound as a red solid (0.71 g, 89%); ^1H NMR (300 MHz, DMSO- d_6) δ 2.46 (t, J = 6.1 Hz, 4 H), 3.79 (t, J = 6.1 Hz, 4 H), 7.11 (d, J = 9.0 Hz, 2 H), 7.48 (d, J = 9.0 Hz, 2 H), 7.56 (s, 1 H); MS (ES) m/z: 316.9 (M-H^-); HRMS Calcd. $\text{C}_{15}\text{H}_{14}\text{N}_2\text{O}_2\text{S}_2(\text{M}^+)$:
25 318.0497. Found: 318.0502.

EXAMPLE 35

5-[4-(1,4-Dioxa-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-thiazolidine-2,4-dione

A mixture of 4-(1,4-dioxa-8-aza-spiro[4.5]dec-8-yl)-benzaldehyde benzaldehyde(Taylor, E. C., Skotnicki, J. S. *Synthesis*, **1981**, 606)(15 g, 60 mol), 2,4-thiazolidinedione (7.0 g, 60 mmol), and piperidine (8.0 mL, 81.2 mmol) in 450 mL of ethanol was refluxed for 6 hours. The solid which was formed on cooling the solution was collected to give the title compound as an
30 orange solid (20.5 g, 99%); ^1H NMR (300 MHz, DMSO- d_6) δ 1.67 (t, J = 5.6 Hz, 4 H), 3.47 (t, J = 5.6 Hz, 4 H), 3.92 (s, 4 H), 7.07 (d, J = 9.0 Hz, 2 H), 7.43 (d, J = 9.0 Hz, 2 H), 7.67 (s, 1 H),

12.40 (brs, 1 H); MS (ES) m/z: 346.8 (MH⁺); HRMS Calcd. for C₁₇H₁₉N₂O₄S(MH⁺): 346.0987. Found: 346.0994. Anal. Calcd. for C₁₇H₁₈N₂O₄S: C, 58.94; H, 5.24; N, 8.09. Found: C, 58.92; H, 5.11; N, 7.96.

5 EXAMPLE 36

5-[4-(Oxo-piperidin-1-yl)-benzylidene]-thiazolidine-2,4-dione

The title compound was prepared from 5-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-thiazolidine-2,4-dione (which was obtained in example 35) according to the procedure of Example 34 as an orange solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.45 (t, J = 6.0 Hz, 4 H), 3.76 (d, J = 6.0 Hz, 4 H), 7.10 (d, J = 9.0 Hz, 2 H), 7.48 (d, J = 9.0 Hz, 2 H), 7.70 (s, 1 H), 12.41 (brs, 1 H); MS (ES) m/z: 301.0 (M-H)⁻; HRMS Calcd. for C₁₅H₁₄N₂O₃S(M⁺): 302.0726. Found: 302.0731.

EXAMPLE 37

15 5-[4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-benzyl]-thiazolidine-2,4-dione

Method A: A solution of 5-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-thiazolidine-2,4-dione (which was obtained in Example 35) (8.0 g, 23 mmol) in acetic acid (75 mL) and THF(225 mL) was hydrogenated (40 psi hydrogen) in a Parr shaker over 10% Pd/C (8 g) over 4 days. The catalyst was removed by filtration over celite and the solvent was evaporated. The product was purified by flash silica gel chromatography (hexanes/ethyl acetate) to give the title compound as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.68 (t, J = 5.6 Hz, 4 H), 2.76 (dd, J = 14.1, 11.0 Hz, 1 H), 3.22 (t, J = 5.6 Hz, 4 H), 3.30 (dd, J = 14.1, 3.8 Hz, 1 H), 3.91 (s, 4 H), 4.50 (dd, J = 11.0, 3.8 Hz, 1 H), 6.86 (d, J = 8.7 Hz, 2 H), 7.04 (d, J = 8.7 Hz, 2 H); MS (ES) m/z: 349.3 (MH⁺); HRMS Calcd. for C₁₇H₂₀N₂O₄S(M⁺): 348.1144. Found: 348.1146. Anal. Calcd. for C₁₇H₂₀N₂O₄S: C, 58.60; H, 5.79; N, 8.04. Found: C, 58.42; H, 5.67; N, 7.86.

Method B: A mixture of 5-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-thiazolidine-2,4-dione (9.0 g, 25.9 mmol) (which was obtained in Example 35) and 5% sodium mercury amalgam(Na-Hg) (46g, 100 mmol) in water (70 mL) and THF (200 mL) was stirred at room temperature overnight. The organic layer was decanted from mercury (Hg) and water. Evaporation of the solvent gave the title compound as an off-white solid. The product was found to be identical with that prepared by method A.

EXAMPLE 385-[4-(4-Oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione

The title compound was prepared from 5-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 37) according to the procedure of Example 34 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.40 (t, J = 5.9 Hz, 4 H), 3.01 (dd, J = 14.1, 9.2 Hz, 1 H), 3.29 (dd, J = 14.1, 4.2 Hz, 1 H), 3.57 (t, J = 5.9 Hz, 4 H), 4.86 (dd, J = 9.2, 4.2 Hz, 1 H), 6.96 (d, J = 8.6 Hz, 2 H), 7.10 (d, J = 8.6 Hz, 2 H); MS (ES) m/z: 304.8 (MH⁺, 100%), 609.0 (2MH⁺, 100%), 914.1 (3MH⁺, 10%); HRMS Calcd. for C₁₅H₁₆N₂O₃S(M⁺): 304.0881. Found: 304.0905. Anal. Calcd. for C₁₅H₁₆N₂O₃S: C, 59.19; H, 5.36; N, 9.20. Found: C, 58.96; H, 5.16; N, 8.91.

EXAMPLE 395-[4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-imidazolizolidine-2,4-dione

The title compound was prepared from 4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzaldehyde benzaldehyde(Taylor, E. C., Skotnicki, J. S. *Synthesis*, **1981**, 606) and hydantoin according to the procedure of Example 35 as an orange solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.68 (t, J = 5.8 Hz, 4 H), 3.38 (t, J = 5.8 Hz, 4 H), 3.91 (s, 4 H), 6.34 (s, 1 H), 6.95 (d, J = 8.7 Hz, 2 H), 7.49 (d, J = 8.7 Hz, 2 H), 10.33 (brs, 1 H), 11.05 (brs, 1 H); MS (ES) m/z: 330.0 (MH⁺); HRMS Calcd. for C₁₇H₂₀N₃O₄(MH⁺): 330.1454. Found: 330.1477.

EXAMPLE 405-[4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-benzyl]-imidazolizolidine-2,4-dione

The title compound was prepared from 5-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-imidazolizolidine-2,4-dione (which was obtained in Example 39) according to the procedure of Example 37 as an orange solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.68 (t, J = 5.7 Hz, 4 H), 2.56 (dd, J = 13.9, 6.8 Hz, 1 H), 2.81 (dd, J = 13.9, 4.1 Hz, 1 H), 3.16 (t, J = 5.7 Hz, 4 H), 3.74-3.85 (m, 1 H), 3.90 (s, 4 H), 6.82 (d, J = 8.7 Hz, 2 H), 6.96 (d, J = 8.7 Hz, 2 H), 8.32 (s, 2 H); MS (ES) m/z: 331.9 (MH⁺); HRMS Calcd. for C₁₇H₂₂N₃O₄(MH⁺): 332.1610. Found: 332.1639.

EXAMPLE 415-[4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-2-imino-thiazolidin-4-one

The title compound was prepared from 4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzaldehyde benzaldehyde(Taylor, E. C., Skotnicki, J. S. *Synthesis*, **1981**, 606) and

pseudothiohydantoin according to the procedure of Example 35 as an orange solid; ^1H NMR (300 MHz, DMSO- d_6) δ 1.68 (t, J = 5.6 Hz, 4 H), 3.43 (t, J = 5.6 Hz, 4 H), 3.91 (s, 4 H), 7.06 (d, J = 8.9 Hz, 2 H), 7.41 (d, J = 8.9 Hz, 2 H), 7.48 (s, 1 H), 8.99 (brs, 1 H), 9.33 (brs, 1 H); MS (ES) m/z: 345.9 (MH^+); HRMS Calcd. for $\text{C}_{17}\text{H}_{20}\text{N}_3\text{O}_3\text{S}$ (MH^+): 346.1226. Found: 346.1205.

5 Anal. Calcd. for $\text{C}_{17}\text{H}_{19}\text{N}_3\text{O}_3\text{S}$: C, 59.11; H, 5.54; N, 12.16. Found: C, 58.80; H, 5.71; N, 12.38.

EXAMPLE 42

5-[4-(4-Oxo-piperidin-1-yl)-benzylidene]-imidazolidine-2,4-dione

The title compound was prepared from 5-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-imidazolidine-2,4-dione (which was obtained in Example 39) according to the procedure of Example 34 as a yellowish solid; ^1H NMR (300 MHz, DMSO- d_6) δ 2.43 (t, J = 6.0 Hz, 4 H), 3.70 (t, J = 6.0 Hz, 4 H), 6.36 (s, 1 H), 7.01 (d, J = 9.0 Hz, 2 H), 7.53 (d, J = 9.0 Hz, 2 H), 10.35 (brs, 1 H), 11.10 (brs, 1 H); MS (ES) m/z: 285.9 (MH^+); HRMS Calcd. for $\text{C}_{15}\text{H}_{16}\text{N}_3\text{O}_3$ (MH^+): 286.1192. Found: 286.1169.

EXAMPLE 43

1-[4-(2-Imino-4-oxo-thiazolidin-5-ylidenemethyl)-phenyl]-piperidin-4-one

The title compound was prepared from 5-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-2-imino-thiazolidin-4-one (which was obtained in Example 41) according to the procedure of Example 34 as a yellowish solid; ^1H NMR (300 MHz, DMSO- d_6) δ 2.44 (t, J = 6.0 Hz, 4 H), 3.74 (t, J = 6.0 Hz, 4 H), 7.14 (d, J = 6.7 Hz, 2 H), 7.46 (d, J = 6.7 Hz, 2 H), 7.50 (s, 1 H), 9.00 (brs, 1 H), 9.24 (brs, 1 H); MS (ES) m/z: 301.9 (MH^+).

EXAMPLE 44

5-[4-(4-Oxo-piperidin-1-yl)-benzyl]-imidazolidine-2,4-dione

The title compound was prepared from 5-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzyl]-imidazolidine-2,4-dione (which was obtained in example 40) according to the procedure of Example 34 as an off-white solid; ^1H NMR (300 MHz, DMSO- d_6) δ 2.39 (t, J = 6.0 Hz, 4 H), 2.83 (d, J = 4.8 Hz, 2 H), 3.55 (t, J = 6.0 Hz, 4 H), 4.25 (t, J = 4.8 Hz, 1 H), 6.92 (d, J = 8.7 Hz, 2 H), 7.05 (d, J = 8.7 Hz, 2 H), 7.91 (s, 1 H); MS (ES) m/z: 287.9 (MH^+); HRMS Calcd. for $\text{C}_{15}\text{H}_{18}\text{N}_3\text{O}_3$ (MH^+): 288.1348. Found: 288.1396.

EXAMPLE 45**1-[4-(2-Imino-4-oxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-one**

The title compound was prepared from 5-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-2-imino-thiazolidin-4-one (which was obtained in Example 41) according to the procedures of Example 37 and Example 34 as a yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.40 (t, J = 5.9 Hz, 4 H), 2.79 (dd, J = 14.2, 9.7 Hz, 1 H), 3.28 (dd, J = 14.2, 4.0 Hz, 1 H), 3.56 (t, J = 5.9 Hz, 4 H), 4.54 (dd, J = 9.7, 4.0 Hz, 1 H), 6.92 (d, J = 8.6 Hz, 2 H), 7.10 (d, J = 8.6 Hz, 2 H), 8.68 (brs, 1 H), 8.90 (brs, 1 H); MS (ES) m/z: 303.9 (MH⁺); HRMS Calcd. for C₁₅H₁₈N₃O₅S (MH⁺): 304.1119. Found: 304.1113.

EXAMPLE 46**8-[4-(1H-Tetrazol-5-yl)-phenyl]-1,4-dioxo-8-aza-spiro[4.5]decane**

A mixture of 4-(1,4-dioxo-8-azaspiro(4.5)dec-8-yl)benzonitrile benzaldehyde (Taylor, E. C., Skotnicki, J. S. *Synthesis*, **1981**, 606) (10 mmol, 2.44g), sodium azide (30 mmol, 1.95g) and triethylamine hydrochloride (30 mmol, 4.13g) in toluene was heated to ~95 °C over night (Koguro, K., Oga, T., Missui, S. and Orita, R. *Synthesis*, **1998**, 910). After cooling the mixture was poured into water and the solid which was formed was collected. To the aqueous layer 36% hydrochloric acid was added dropwise to salt out more solid. The combined solids were dried to yield the title compound as an off- white solid (2.30 g, 80%); ¹H NMR (300 MHz, DMSO-d₆) δ 1.70 (t, J = 5.7 Hz, 4 H), 3.44 (t, J = 5.7 Hz, 4 H), 3.92(s, 4 H), 7.12(d, J = 9.0 Hz, 2 H), 7.85(d, J = 9.0 Hz, 2 H); MS (ES) m/z: 288.4 (MH⁺); HRMS Calcd. for C₁₄H₁₇N₅O(M⁺): 287.1382. Found: 287.1375.

EXAMPLE 47**1-[4-(1H-Tetrazol-5-yl)-phenyl]-piperidin-4-one**

The title compound was prepared from 8-[4-(1H-tetrazol-5-yl)-phenyl]-1,4-dioxo-8-aza-spiro[4.5]decane (which was obtained in Example 46) according to the procedures of Example 34 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.45 (t, J = 6.0 Hz, 4 H), 3.75 (t, J = 6.0 Hz, 4 H), 7.18(d, J = 9.0 Hz, 2 H), 7.91 (d, J = 9.0 Hz, 2 H); MS (ES) m/z: 244.0 (MH⁺); HRMS Calcd. for C₁₂H₁₃N₅O(M⁺): 243.1120. Found: 243.1120.

EXAMPLE 48

Ethyl {5-[4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)phenyl]-2H-tetraazol-2-yl}acetate and ethyl{5-[4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)phenyl]-1H-tetraazol-1-yl}acetate

To a solution of 8-[4-(1H-tetrazol-5-yl)-phenyl]-1,4-dioxo-8-aza-spiro[4.5]decane (0.57 g, 2 mmol) (which was obtained in Example 46) in DMF (10 mL) was added cesium carbonate (0.81 g, 2.5 mmol) and ethyl iodoacetate (0.43 g, 2 mmol). The mixture was stirred at room temperature over night, then the reaction was quenched with water, extracted with ethyl acetate. The products from the organic phase was separated by silica gel chromatography (ethyl acetate/hexanes) to yield ethyl{5-[4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)phenyl]-2H-tetraazol-2-yl}acetate as a colorless crystal (0.55 g, 73%) and ethyl{5-[4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)phenyl]-1H-tetraazol-1-yl}acetate as a gum (0.12 g, 16%).

Ethyl{5-[4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)phenyl]-2H-tetraazol-2-yl}acetate: ^1H NMR (300 MHz, CDCl_3) δ 1.23(t, J = 7.1 Hz, 3 H), 1.84 (t, J = 5.8 Hz, 4 H), 3.45 (t, J = 5.8 Hz, 4 H), 4.00(s, 4 H), 4.28 (q, J = 7.1 Hz, 2 H), 5.42(s, 2 H), 7.01(d, J = 9.0 Hz, 2 H), 8.02 (d, J = 9.0 Hz, 2 H); MS (ES) m/z: 374.3 (MH^+); HRMS Calcd. for $\text{C}_{18}\text{H}_{23}\text{N}_5\text{O}_4(\text{M}^+)$: 373.1750. Found: 373.1750.

Ethyl{5-[4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)phenyl]-1H-tetraazol-1-yl}acetate: ^1H NMR (300 MHz, CDCl_3) δ 1.26(t, J = 7.1 Hz, 3 H), 1.79 (t, J = 5.7 Hz, 4 H), 3.49 (t, J = 5.7 Hz, 4 H), 4.00(s, 4 H), 4.26 (q, J = 7.1 Hz, 2 H), 5.19(s, 2 H), 7.00(d, J = 8.7 Hz, 2 H), 7.54 (d, J = 8.7 Hz, 2 H); MS (ES) m/z: 374.3 (MH^+); HRMS Calcd. for $\text{C}_{18}\text{H}_{23}\text{N}_5\text{O}_4(\text{M}^+)$: 373.1750. Found: 373.1761.

EXAMPLE 49

tert-Butyl 2-[2,4-dioxo-5-[4-(4-oxo-1-piperidiny)benzyl]-1,3-thiazolidin-3-yl}acetate

Sodium hydride (60% in mineral oil, 66 mg, 1.65 mmol) was added into a mixture of 5-[4-(4-oxo-1-piperidiny)benzyl]-1,3-thiazolidine-2,4-dione (500 mg, 1.65 mmol)(which was obtained in Example 38), and DMF. The mixture was stirred for 1 hour at room temperature, and then tert-butyl bromoacetate (0.36 mL, 2.47 mmol) was added. The new mixture was stirred for 30 minutes, poured into water, and extracted with ethyl acetate. The organic extracts were dried over MgSO_4 . Evaporation and purification by flash chromatography (hexanes/ethyl acetate 3/1) gave a viscous oil (525 mg, 76% yield); ^1H NMR (300 MHz, $\text{DMSO}-d_6$) δ 1.40 (s, 9H), 2.40 (m, 4H), 2.9 (m, 1H), 3.45 (m, 1H), 3.56 (m, 4H), 4.20 (s, 2H), 5.05 (m, 1H), 6.97 (m,

2H), 7.18 (m, 2H); MS (ES) m/z: 419 (MH⁺); Anal. Calcd. for C₁₅H₁₆N₂O₃S : C, 60.27; H, 6.26; N, 6.69. Found: C, 60.21; H, 6.44; N, 6.52.

EXAMPLE 50

5 Ethyl 2-{2,4-dioxo-5-[4-(4-oxo-1-piperidiny)benzyl]-1,3-thiazolidin-3-yl}acetate

Sodium hydride (60% in mineral oil, 66 mg, 1.65 mmol) was added into a mixture of 5-[4-(4-oxo-1-piperidiny)benzyl]-1,3-thiazolidine-2,4-dione (500 mg, 1.65 mmol) (which was obtained in Example 38) and DMF. The mixture was stirred for one hour at room temperature, and then ethyl bromoacetate (0.27 mL, 2.47 mmol) was added. The new mixture was stirred
10 for 30 minutes, poured into water, and extracted with ethyl acetate. The organic extracts were dried over MgSO₄. Evaporation and purification by flash chromatography (hexanes/ethyl acetate 2/1) gave a viscous oil (295 mg, 46% yield); ¹H NMR (300 MHz, DMSO-d₆) δ 1.20 (t, J = 7.16 Hz, 3H), 2.40 (m, 4H), 2.95-3.00 (m, 1H), 3.4 (m, 1H), 3.60 (m, 2H), 4.10 (q, J = 7.16 Hz, 2H), 4.30 (s, 2H), 6.97 (m, 2H), 7.16 (m, 2H); MS (ES) m/z: 391 (MH⁺);

15

EXAMPLE 51

4-(1,4-Dioxa-8-azaspiro[4.5]dec-8-yl)benzaldehyde oxime

A solution of sodium acetate (6.64 g, 60.72 mmol) in water (10 mL) was added into a mixture of 4-(1,4-dioxa-8-azaspiro[4.5]dec-8-yl)benzaldehyde (5.0 g, 20.24 mmol)
20 benzaldehyde (Taylor, E. C., Skotnicki, J. S. *Synthesis*, **1981**, 606), hydroxylamine hydrochloride (4.22 g, 60.72 mmol), ethyl alcohol (300 mL), and water (50 mL). The mixture was stirred at 70 °C for 10 hours, then poured into water and extracted with ethyl acetate. The organic extracts were dried over MgSO₄. Evaporation and purification by flash chromatography (hexanes/ethyl acetate 2/1) gave a white solid (6.3 g, 90% yield); mp 151-152 °C; ¹H NMR
25 (400 MHz, DMSO-d₆) δ 1.63 (m, 4H), 3.35 (m, 4H), 3.90 (s, 4H), 6.96 (m, 2H), 7.40 (m, 2H), 7.96 (s, 1H), 10.75 (s, 1H); MS (ES) m/z: 263 (MH⁺); Anal. Calcd. for C₁₄H₁₈N₂O₃: C, 64.11; H, 6.92; N, 10.68. Found: C, 64.24; H, 6.81; N, 10.64.

EXAMPLE 52

30 8-[4-[(Hydroxyamino)methyl]phenyl]-1,4-dioxa-8-azaspiro[4.5]decane

Hydrochloric acid (4N, in dioxane) was added dropwise into a mixture of 4-(1,4-dioxa-8-azaspiro[4.5]dec-8-yl)benzaldehyde oxime (5.3 g, 20.24 mmol) (which was obtained in Example 51), sodium cyanoborohydride (6.3 g, 101.2 mmol), methyl alcohol (200 mL), and methyl orange (10 mg), until an acidic solution (pH about 4) was achieved. The mixture was
35 then stirred for 1 hour, poured into water, neutralized with NaOH (2N) and extracted with ethyl

acetate. The organic extracts were dried over MgSO₄. Evaporation and purification by flash chromatography (hexanes/ethyl acetate/methyl alcohol 10/5/1) gave a white solid (4.2 g, 78% yield); mp 107-109 °C; ¹H NMR (400 MHz, DMSO-d₆) δ 1.64 (m, 4H), 3.20 (m, 4H), 3.74 (s, 2H), 3.90 (s, 4H), 5.84 (brs, 1H), 6.86 (m, 2H), 7.14 (m, 2H), 7.19 (brs, 1H); MS (ES) m/z: 265 (MH⁺).

EXAMPLE 53

N-[4-(1,4-Dioxa-8-azaspiro[4.5]dec-8-yl)benzyl]-N-hydroxyurea

Trimethylsilyl isocyanate (2.1 mL, 14.85 mmol) was added dropwise into a mixture of 8-{4-[(hydroxyamino)methyl]phenyl}-1,4-dioxa-8-azaspiro[4.5]decane (2.61 g, 9.9 mmol) (which was obtained in Example 52), THF(20 mL) and dioxane (20 mL). The mixture was stirred at room temperature for 24 hours, poured into water and extracted with ethyl acetate. The organic extracts were dried over MgSO₄. Evaporation and purification by flash chromatography (hexanes/ethyl acetate/methyl alcohol 10/5/1) gave a white solid (2.2 g, 73% yield); mp 153-154 °C; ¹H NMR (400 MHz, DMSO-d₆) δ 1.70 (m, 4H), 3.21 (m, 4H), 3.89 (s, 4H), 4.37 (s, 2H), 6.23 (brs, 2H), 6.86 (m, 2H), 7.10 (m, 2H), 9.19 (s, 1H); MS (ES) m/z: 308 (MH⁺); Anal. Calcd. for C₁₅H₂₁N₃O₄: C, 58.62; H, 6.89; N, 13.67. Found: C, 58.37; H, 6.78; N, 13.47

EXAMPLE 54

N-Hydroxy-N-[4-(4-oxo-1-piperidiny)benzyl]urea

A mixture of N-[4-(1,4-dioxa-8-azaspiro[4.5]dec-8-yl)benzyl]-N-hydroxyurea (2.2 g, 7.16 mmol) (which was obtained in Example 53) and hydrochloric acid (concentrated, 10 mL) was stirred at room temperature for three days. The mixture was then neutralized with ammonium hydroxide, and extracted with ethyl acetate. The organic extracts were dried over MgSO₄. Evaporation and purification by flash chromatography (ethyl acetate) gave a white solid (1.86 g, 98% yield); mp 138-140 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 2.41 (m, 4H), 3.60 (m, 4H), 4.43 (s, 2H), 6.37 (brs, 2H), 7.03 (m, 2H), 7.21 (m, 2H), 9.31 (s, 1H); MS (ES) m/z: 264 (MH⁺);

EXAMPLE 55

2-[4-(4-Oxo-1-piperidiny)benzyl]-1,2,4-oxadiazolidine-3,5-dione

Sodium hydride (60% in mineral oil, 456 mg, 11.4 mmol) was added into a mixture of N-hydroxy-N-[4-(4-oxo-1-piperidiny)benzyl]urea (1.5 g, 5.7 mmol) (which was obtained in Example 54), and THF(10 mL). The mixture was stirred at room temperature for 2 hours, and then methyl chloroformate (2.0 mL, 22.8 mmol) was added. The new mixture was stirred for 2

hours, poured into water, acidified with hydrochloric acid (2 N) to pH about 6, and extracted with ethyl acetate. The organic extracts were dried over MgSO_4 . Evaporation gave a yellow solid (1.58 g). Part of those material (460 mg, 1.43 mmol) was taken in DMF (4 mL) and treated with sodium hydride (60% in mineral oil, 57.3 mg, 1.43 mmol). The mixture was stirred for 1 hour, poured into water, acidified with hydrochloric acid (2N) and extracted with ethyl acetate. The organic extracts were dried over MgSO_4 . Evaporation and purification by flash chromatography (hexanes/ethyl acetate 1/1) gave the title compound as a yellow solid (3.55 g, 85% yield); ^1H NMR (300 MHz, DMSO-d_6) δ 2.42 (m, 4H), 3.62 (m, 4H), 4.76 (s, 2H), 7.1 (m, 2H), 7.23 (m, 2H), 12.43 (brs, 1H); MS (ES) m/z : 290 (MH^+).

EXAMPLE 56

3-Bromo-4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzaldehyde

A mixture of 1,4-dioxo-8-azaspiro[4.5]decane (6.87 g, 48 mmol), 3-bromo-4-fluorobenzaldehyde (8.12 g, 40 mmol), and potassium carbonate (6.63 g, 48 mmol) in 1,3-dimethyl-3,4,5,6-tetrahydro-2(1H)-pyrimidinone (12 mL) and acetonitrile (8 mL) was heated at 80 °C under N_2 atmosphere for one day. Reaction mixture was cooled down to room temperature and poured onto water (150 mL). The mixture was extracted with methylene chloride. The organic layer was dried (MgSO_4) and concentrated to give the title compound as an off-white solid (12.4 g, 96%); mp 63-64 °C; ^1H NMR (300 MHz, CDCl_3) δ 1.93 (t, J = 5.7 Hz, 4H), 3.25 (t, J = 5.4 Hz, 4H), 4.02 (s, 4H), 7.12 (d, J = 4.2 Hz, 1H), 7.75 (dd, J = 8.4, 2.1 Hz, 2H), 8.06 (d, J = 1.8 Hz, 1H), 9.84 (s, 1H); MS (ES) m/z : 325.7 (MH^+); HRMS Calcd. for $\text{C}_{14}\text{H}_{16}\text{BrNO}_3$ (MH^+): 325.0314. Found: 325.0288.

EXAMPLE 57

5-[3-Bromo-4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-thiazolidine-2,4-dione

The title compound was prepared from 3-bromo-4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzaldehyde (which was obtained in Example 56), 2,4-thiazolidinedione and β -alanine according to the procedure of Example 33 as a yellow solid; mp 109-111 °C; ^1H NMR (300 MHz, DMSO-d_6) δ 1.79 (t, J = 5.1 Hz, 4H), 3.12 (m, 4H), 3.93 (s, 4H), 6.87 (d, J = 8.7 Hz, 1H), 7.52-7.55 (m, 1H), 7.61 (s, 1H), 7.83-7.87 (m, 1H), 12.5 (s, 1H); MS (ES) m/z : 425.1 (MH^+).

EXAMPLE 58**5-[3-Bromo-4-(4-oxo-piperidin-1-yl)-benzylidene]-thiazolidine-2,4-dione**

The title compound was prepared from 5-[3-bromo-4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-thiazolidine-2,4-dione (which was obtained in Example 57) according to the
5 procedure of Example 34 as a yellow solid; mp > 210 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 2.54 (t, J = 4.5 Hz, 4H), 3.37 (t, J = 4.5 Hz, 4H), 7.32 (d, J = 6.3 Hz, 1H), 7.56 (dd, J = 6.3, 1.5 Hz, 1H), 7.74 (s, 1H), 7.88 (d, J = 1.5 Hz, 1H), 12.6 (s, 1H); MS (ES) m/z: 380.8 (MH⁺); HRMS Calcd. for C₁₅H₁₄BrN₂O₃S(MH⁺): 380.9909. Found: 380.9874.

EXAMPLE 59**4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-3-fluoro-benzaldehyde**

The title compound was prepared from 1,4 dioxo-8-azaspiro[4.5]decane and 3,4-difluorobenzaldehyde according to the procedure of Example 56 as an orange oil; ¹H NMR (300 MHz, CDCl₃) δ 1.88 (t, J = 5.7 Hz, 4H), 3.35 (t, J = 5.8 Hz, 4H), 4.01 (s, 4H), 6.96 (t, J =
15 7.8 Hz, 1H), 7.47-7.49 (m, 1H), 7.53-7.58 (m, 1H), 9.81 (s, 1H); MS (ES) m/z: 265.8 (MH⁺).

EXAMPLE 60**5-[4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-3-fluoro-benzylidene]-thiazolidine-2,4-dione**

The title compound was prepared from 4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-3-fluoro-benzaldehyde (which was obtained in Example 59), 2,4 thiazolidinedione and β-alanine
20 according to the procedure of Example 33 as an orange solid; mp 159-160 °C; ¹H NMR (300 MHz, CDCl₃) δ 7.01 (m, 1H), 7.13-7.22 (m, 2H), 7.71-7.77 (m, 1H); MS (ES) m/z: 363.3 (M-H)⁻.

EXAMPLE 61**5-[3-Fluoro-4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione**

The title compound was prepared from 5-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-3-fluoro-benzylidene]-thiazolidine-2,4-dione (which was obtained in Example 60) according to the
procedures of Example 37 and Example 34 as a yellow solid; mp 129-130 °C; ¹H NMR (300 MHz, CDCl₃) δ 2.62 (t, J = 6.0 Hz, 4H), 3.09-3.19 (m, 2H), 3.40 (t, J = 6.0 Hz, 4H), 4.47-4.54
30 (m, 1H), 6.88-7.00 (m, 3H), 8.22 (brs, 1H); MS (ES) m/z: 322.9 (MH⁺); HRMS Calcd. for C₁₅H₁₆FN₂O₃S (MH⁺): 323.0865. Found: 323.0837.

EXAMPLE 625-[3-Fluoro-4-(4-oxo-piperidin-1-yl)-benzylidene]-thiazolidine-2,4-dione

The title compound was prepared from 5-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-3-fluoro-benzylidene]-thiazolidine-2,4-dione (which was obtained in Example 60) according to the
5 procedure of Example 34 as a yellow solid; mp > 200 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 2.51 (m, 4H), 3.54 (t, J = 5.97 Hz, 4H), 7.24-7.30 (m, 1H), 7.31-7.49 (m, 2H), 7.73 (s, 1H), 12.5 (s, 1H); MS (ES) m/z: 319.0 (M-H)⁻; HRMS Calcd. for C₁₅H₁₄FN₂O₃S(MH⁺): 321.0709. Found: 321.0712

EXAMPLE 63N-[5-((1R)-2-{1-[4-(3,5-Dioxo-[1,2,4]oxadiazolidin-2-yl)methyl]-phenyl}-piperidin-4-ylamino)-1-hydroxy-ethyl]-2-hydroxy-phenyl-methanesulfonamide

Acetic acid (0.09 mL, 1.6 mmol) was added to a mixture of N-{5-[(1R)-2-amino-1-hydroxyethyl]-2-hydroxyphenyl}methanesulfonamide (197 mg, 0.8 mmol) (which was obtained
15 in Example 10), 2-[4-(4-oxo-1-piperidiny]benzyl]-1,2,4-oxadiazolidine-3,5-dione (231 mg, 0.8 mmol) (which was obtained in Example 55), and DMF (5 mL). The mixture was stirred for 20 minutes and then, sodium triacetoxyborohydride (203 mg, 0.96 mmol) was added, and the new mixture was stirred at room temperature for 24 hours. The volatiles were removed in vacuo and the residue was purified by flash chromatography (dichloromethane/methyl alcohol 4/1) to
20 produce an off-white solid (296 mg, 71% yield); mp 193-195 °C; ¹H NMR (400 MHz, DMSO-d₆) δ 1.58-1.62 (m, 2H), 1.96-2.07 (m, 2H), 2.60-2.70 (m, 2H), 2.86-3.17 (m, 6H), 3.72-3.8 (m, 2H), 4.28 (s, 2H), 2.70-2.74 (m, 1H), 6.83-6.87 (m, 3H), 7.03-7.13 (m, 3H), 7.23 (m, 1H), 8.60 (brs, 2H); MS (ES) m/z: 518 (M-H)⁻.

EXAMPLE 645-[4-[4-[(R)-2-Hydroxy-2-[4-hydroxy-3-[(methylsulfonyl)amino]phenyl]ethyl]amino]-1-piperidinyl]phenyl]methyl]-2,4-dioxo-3-thiazolidineacetic acid tert-butyl-ester

Acetic acid (0.12 mL, 2.16 mmol) was added to a mixture of N-{5-[(1R)-2-amino-1-hydroxyethyl]-2-hydroxyphenyl}methanesulfonamide (266 mg, 1.08 mmol) (which was obtained
30 in Example 10), *tert*-butyl 2-{2,4-dioxo-5-[4-(4-oxo-1-piperidiny]benzyl]-1,3-thiazolidin-3-yl}acetate (450 mg, 1.08 mmol) (which was obtained in Example 49), and DMF (5 mL). The mixture was stirred for 20 minutes and then, sodium triacetoxyborohydride (276 mg, 1.3 mmol) was added, and the new mixture was stirred at room temperature for 24 hours. The volatiles were removed in vacuo and the residue was purified by flash chromatography
35 (dichloromethane/methyl alcohol 5/1) to produce a yellow solid (480 mg, 68% yield); mp 130-

132 °C; ¹H NMR (400 MHz, DMSO-d₆) δ 1.20-1.50 (m, 11 H), 1.81-1.85 (m, 2H), 2.60-2.80 (m, 4H), 2.85-2.9 (m, 4H), 3.40 (m, 1H), 3.60 (m, 1H), 4.20 (s, 2H), 4.50 (m, 1H), 5.04 (m, 1H), 6.80-6.87 (m, 3H), 7.02 (m, 1H), 7.08 (m, 2H), 7.20 (m, 1H); Anal. Calcd. for C₃₀H₄₀N₄O₈S₂: C, 55.54; H, 6.21; N, 8.64. Found: C, 53.86; H, 6.11; N, 7.65.

5

EXAMPLE 65

5-[[4-[4-[(R)-2-Hydroxy-2-[4-hydroxy-3-[(methylsulfonyl)amino]phenyl]ethyl]amino]-1-piperidinyl]phenyl]methyl]-2,4-dioxo-3-thiazolidineacetic acid

A mixture of 5-[[4-[4-[(R)-2-hydroxy-2-[4-hydroxy-3-[(methylsulfonyl)amino]phenyl]ethyl]amino]-1-piperidinyl]phenyl]methyl]-2,4-dioxo-3-thiazolidineacetic acid tert-butyl-ester (300 mg, 0.46 mmol) (which was obtained in Example 64), dichloromethane (5 mL), and trifluoroacetic acid (0.5 mL) was stirred at room temperature for 10 hours. The mixture was then poured into ethyl ether (50 mL), and the precipitated solid was filtered and dried to give an off-white solid (189 mg, 58 % yield); mp 158-160 °C; ¹H NMR (400 MHz, DMSO-d₆) δ 1.58-1.66 (m, 2H), 2.02-2.10 (m, 2H), 2.60-2.64 (m, 2H), 2.85-3.04 (m, 4H), 3.16-3.40 (m, 4H), 3.80 (m, 2H), 4.20 (s, 2H), 4.80 (m, 1H), 5.06 (m, 1H), 6.17 (brs, 1H), 6.87-6.91 (m, 3H), 7.05-7.1 (m, 3H), 7.23 (m, 1H), 8.60 (brs, 1H), 8.80 (s, 1H), 9.94 (s, 1H), 13.3 (brs, 1H); MS (ES) m/z: 649 (MH⁺).

EXAMPLE 66

5-[[4-[4-[(R)-2-Hydroxy-2-[4-hydroxy-3-[(methylsulfonyl)amino]phenyl]ethyl]amino]-1-piperidinyl]phenyl]methyl]-2,4-dioxo-3-thiazolidineacetic acid ethyl-ester

Acetic acid (0.05 mL, 0.92 mmol) was added to a mixture of N-{5-[(1R)-2-amino-1-hydroxyethyl]-2-hydroxyphenyl}methanesulfonamide (which was obtained in Example 10) (113 mg, 0.46 mmol), ethyl 2-{2,4-dioxo-5-[4-(4-oxo-1-piperidinyl)benzyl]-1,3-thiazolidin-3-yl}acetate (which was obtained in Example 50) (180 mg, 0.46 mmol), and DMF (3 mL). The mixture was stirred for 20 minutes and then, sodium triacetoxymethylborohydride (117 mg, 0.55 mmol) was added, and the new mixture was stirred at room temperature for 24 hours. The volatiles were removed in vacuo and the residue was purified by flash chromatography (dichloromethane/methyl alcohol 5/1) to produce an off-white solid (210 mg, 74% yield); mp 153-155 °C; ¹H NMR (400 MHz, DMSO-d₆) δ 1.18 (t, J = 7.1 Hz, 3H), 1.30-1.60 (m, 2H), 1.80-1.83 (m, 2H), 2.50-2.65 (m, 4H), 2.80-2.85 (m, 4H), 3.40 (m, 2H), 3.60 (m, 1H), 4.13 (q, J = 7.1 Hz, 2H), 4.47 (m, 1H), 5.04 (m, 1H), 6.80-6.90 (m, 3H), 6.97 (m, 1H), 7.1 (m, 2H), 7.19 (m,

1H); MS (ES) m/z: 621 (MH⁺); Anal. Calcd. for: C₂₈H₃₆N₄O₈S₂ x 1 CH₃CO₂H: C, 52.93; H, 5.92; N, 8.23. Found: C, 52.69; H, 5.63; N, 8.23.

EXAMPLE 67

5 5-(3-Fluoro-4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione

The title compound was prepared from 4-((2S)-3-amino-2-hydroxy-propoxy)-1,3-dihydro-benzoimidazol-2-one (US 5,786,356/1998) and 5-[3-fluoro-4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 61) according to the procedure of Example 63 as a pale yellow solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.56-1.62 (m, 2H), 2.04 (m, 2H), 2.63-2.75 (m, 5H), 2.86-2.95 (m, 4H), 3.01-3.10 (m, 4H), 4.50-4.55 (m, 1H), 5.33 (brs, 1H), 6.57-6.65 (m, 2H), 6.84-7.09 (m, 3H), 8.22 (s, 1H), 7.22-7.29 (m, 1H), 10.55 (s, 1H), 10.65 (s, 1H); MS (ES) m/z: 530.0 (MH⁺); HRMS Calcd. for C₂₅H₂₉FN₅O₅S (MH⁺): 530.1873 . Found: 530.1876.

EXAMPLE 68

15 5-(3-Bromo-4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)propylamino]-piperidin-1-yl}-benzylidene)-thiazolidine-2,4-dione

The title compound was prepared from 4-((2S)-3-amino-2-hydroxy-propoxy)-1,3-dihydro-benzoimidazol-2-one (US 5,786,356/1998) and 5-[3-bromo-4-(4-oxo-piperidin-1-yl)-benzylidene]-thiazolidine-2,4-dione (which was obtained in Example 58) according to the procedure of Example 63 as an olive green solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.66-1.77 (m, 4H), 2.10-2.19 (m, 4H), 2.68-2.76 (m, 2H), 3.07-3.14 (m, 3H), 3.99-4.09 (m, 2H), 5.62 (brs, 1H), 6.58-6.66 (m, 2H), 6.88 (t, J = 8.1 Hz, 1H), 7.20-7.25 (m, 3H), 7.50 (dd, J = 8.5, 2.0 Hz, 1H), 7.75 (d, J = 2.0 Hz, 1H), 10.55 (s, 1H), 10.65 (s, 1H); MS (ES) m/z: 589.9 (MH⁺).

EXAMPLE 69

25 5-(3-Fluoro-4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)propylamino]-piperidin-1-yl}-benzylidene)-thiazolidine-2,4-dione

30 The title compound was prepared from 4-((2S)-3-amino-2-hydroxy-propoxy)-1,3-dihydro-benzoimidazol-2-one (US 5,786,356/1998) and 5-[3-fluoro-4-(4-oxo-piperidin-1-yl)-benzylidene]-thiazolidine-2,4-dione (which was obtained in Example 62) according to the procedure of Example 63 as an olive green solid; mp 162-164 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 1.66-1.74 (m, 2H), 2.07-2.17 (m, 2H), 2.74-2.83 (m, 2H), 3.12-3.15 (m, 2H), 3.43-3.48

(m, 1H), 3.52-3.56 (m, 2H), 3.98-4.11 (m, 1H), 5.63 (brs, 1H), 6.62 (m, 2H), 6.87 (t, J = 8.1 Hz, 1H), 7.18 (t, J = 9.1 Hz, 3H), 7.27-7.35 (m, 1H), 10.60 (s, 1H), 10.7 (s, 1H); MS (ES) m/z: 527.9 (MH⁺); HRMS Calcd. for C₂₅H₂₈FN₅O₅S (MH⁺): 528.1716. Found: 528.1702.

5 EXAMPLE 70

N-[5-(2-{1-[2-Bromo-4-(2,4-dioxo-thiazolidin-5-ylidenemethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide

The title compound was prepared from N-[5-(2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 9) and 5-[3-bromo-4-(4-oxo-piperidin-1-yl)-benzylidene]-thiazolidine-2,4-dione (which was obtained in Example 58) according to the procedure of Example 63 as a dull yellow solid; mp > 200 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 1.70-1.82 (m, 2H), 2.07-2.17 (m, 2H), 2.65-2.73 (m, 3H), 2.95 (s, 3H), 3.07-3.17 (m, 4H), 4.74-4.77 (m, 3H), 6.00 (brs, 1H), 6.89 (d, J = 8.3 Hz, 1H), 7.09 (dd, J = 8.4, 2.0 Hz, 1H), 7.20 (d, J = 8.4 Hz, 1H), 7.26-7.27 (m, 2H), 7.50 (dd, J = 8.4, 2.0 Hz, 1H), 7.75 (d, J = 2.0 Hz, 1H), 8.7 (brs, 1H), 9.9 (brs, 1H); MS (ES) m/z: 612.8 (MH⁺).

EXAMPLE 71

N-[5-(2-{1-[4-(2,4-Dioxo-thiazolidin-5-ylidenemethyl)-2-fluoro-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide

The title compound was prepared from N-[5-(2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 9) and 5-[3-fluoro-4-(4-oxo-piperidin-1-yl)-benzylidene]-thiazolidine-2,4-dione (which was obtained in Example 62) according to the procedure of Example 63 as a yellow solid; mp > 225 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 1.62-1.71 (m, 2H), 2.03-2.12 (m, 2H), 2.70-2.83 (m, 3H), 2.95 (s, 3H), 3.12-3.33 (m, 2H), 3.49-3.52 (m, 2H), 4.72-4.75 (m, 1H), 5.96 (brs, 1H), 6.89 (d, J = 8.1 Hz, 1H), 7.05-7.13 (m, 3H), 7.25-7.38 (m, 3H), 8.70 (brs, 1H), 9.8 (brs, 1H); MS (ES) m/z: 551.0 (MH⁺); HRMS for C₂₄H₂₇FN₄O₆S₂ (MH⁺): 551.1434. Found: 551.1438.

EXAMPLE 72

5-{4-[4-((2S)-2-Hydroxy-3-phenoxy-propylamino)-piperidin-1-yl]-benzylidene}-2-thioxo-thiazolidin-4-one

1-[4-(4-Oxo-2-thioxo-thiazolidin-5-ylidenemethyl)-phenyl]-piperidin-4-one (which was obtained in Example 34) (0.16 g, 0.5 mmol) and (2S)-1-amino-3-phenoxy-propan-2-ol (which was obtained in Example 3) (0.12g, 0.75 mmol) were mixed in 1,2-dichloroethane (10 mL) and

then treated with sodium triacetoxyborohydride (0.16g, 0.75 mmol) and acetic acid (0.045g, 0.75 mmol). After stirring at room temperature under a nitrogen atmosphere for one day the mixture was quenched with 1N sodium hydroxide (NaOH) and then poured into a saturated aqueous sodium bicarbonate (NaHCO₃). The aqueous layer was extracted with dichloromethane and the combined organic layers were dried and concentrated. The residue was purified by preparative thin layer chromatography (16% MeOH/CH₂CH₂) to give the title compound as a pale yellowish solid; mp >220 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.50-1.70 (m, 2 H), 1.90-2.10 (m, 2 H), 2.60-3.40 (m, 7 H), 3.90-4.20 (m, 3 H), 6.70-7.15 (m, 6 H), 7.30 (d, J = 8.8 Hz, 2 H), 7.38 (d, J = 8.8 Hz, 2 H); MS (ES) m/z: 470.0 (MH⁺); HRMS Calcd. for C₂₄H₂₇N₃O₃S₂ (M⁺): 469.1494. Found: 469.1488.

EXAMPLE 73

5-{4-[4-((2S)-2-Hydroxy-3-phenoxy-propylamino)-piperidin-1-yl]-benzyl}-thiazolidin-2,4-dione

5-[4-(4-Oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 38) (0.15 g, 0.5 mmol) and (2S)-1-amino-3-phenoxy-propan-2-ol (which was obtained in Example 3) (0.12g, 0.75 mmol) were mixed in N,N-dimethylformamide (15 mL) and then treated with sodium triacetoxyborohydride (0.16g, 0.75 mmol) and acetic acid (0.045g, 0.75 mmol). After stirring at room temperature under a nitrogen atmosphere for one day the mixture was quenched with 1N NaOH and then poured into a saturated aqueous NaHCO₃. The aqueous solution was extracted with 1-butanol and the combined organic layers were concentrated. The residue was purified by preparative thin layer chromatography (10% MeOH/CH₂CH₂) to give the title compound as a pale yellowish solid; mp 218-220 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 1.30-1.60 (m, 2 H), 1.80-2.00 (m, 2 H), 2.50-3.00 (m, 5 H), 3.00-3.50 (m, 3 H), 3.50-3.70 (m, 2 H), 3.85-4.00 (m, 3 H), 4.48 (dd, J = 9.8, 3.8 Hz, 1 H), 6.85 (d, J = 8.6 Hz, 2 H), 6.90-6.97 (m, 3 H), 7.04 (d, J = 8.6 Hz, 2 H), 7.25-7.38 (m, 3 H); MS (ES) m/z: 456.0 (MH⁺); HRMS Calcd. for C₂₄H₂₉N₃O₄S (M⁺): 455.1878. Found: 455.1880.

EXAMPLE 74

5-(4-{4-[(2S)-3-(4-Benzyloxy-phenoxy)-2-hydroxy-propylamino]-piperidin-1-yl}benzyl)thiazolidine-2,4-dione

The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 38) and (2S)-1-amino-3-(4-benzyloxy-phenoxy)-propan-2-ol (which was obtained in Example 4) according to the procedure of Example 73 as a pale yellowish solid; mp >70 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.45-1.60 (m,

2 H), 1.90-2.15 (m, 2 H), 2.67 (brt, J = 11.7 Hz, 2 H), 2.75-3.05 (m, 4 H), 3.26 (dd, J = 14.1, 3.9 Hz, 1 H), 3.60-3.75 (m, 2 H), 3.80-3.95 (m, 2 H), 3.95-4.05 (m, 1 H), 4.62 (dd, J = 9.5, 4.0 Hz, 1 H), 5.04 (s, 2 H), 6.60-7.05 (m, 6 H), 7.05 (d, J = 8.6 Hz, 2 H), 7.25-7.45 (m, 5 H); MS (ES) m/z: 562.0 (MH⁺, 100%); 1123.5 (2MH⁺, 5%). HRMS Calcd. for C₃₁H₃₆N₃O₅S (M⁺): 562.2375.

5 Found: 562.2392.

EXAMPLE 75

5-(4-{4-[(2S)-2-Hydroxy-3-(2-oxo-2,3-dihydro-1H-benzimidazol-4-yloxy)-propylamino]-piperidin-1-yl}-benzylidene)-thiazolidine-2,4-dione

10 The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzylidene]-thiazolidine-2,4-dione (which was obtained in Example 36) and (S)-4-[2-hydroxy-3-amino-propoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) according to the procedure of Example 73 as a pale yellowish solid; mp >240 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.45-1.60 (m, 2 H), 2.00-2.15 (m, 2 H), 2.86 (brt, J = 9.0 Hz, 2 H), 2.90-3.60 (m, 15 3 H), 3.91 (brd, J = 9.4 Hz, 1 H), 3.93-4.10 (m, 3 H), 5.40 (brs, 1 H), 6.59 (d, J = 6.0 Hz, 1 H), 6.63 (d, J = 6.0 Hz, 1 H), 6.86 (t, J = 6.0 Hz, 1 H), 7.02 (d, J = 6.6 Hz, 2 H), 7.36 (s, 1 H), 7.40 (d, J = 6.6 Hz, 2 H), 11.60 (s, 1 H), 11.70 (brs, 1 H); MS (ES) m/z: 509.9 (MH⁺); HRMS Calcd. for C₂₅H₂₈N₅O₅S (MH⁺): 510.1811. Found: 510.1861.

20 EXAMPLE 76

5-(4-{4-[(2S)-2-Hydroxy-3-(4-hydroxy-phenoxy)-propylamino]-piperidin-1-yl}-benzylidene)-thiazolidine-2,4-dione

The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzylidene]-thiazolidine-2,4-dione (which was obtained in Example 36) and 4-[(2S)-3-amino-2-hydroxy-propoxy]-phenol (which was obtained in Example 5) according to the procedure of Example 73 as a pale yellowish solid; mp >208 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.60 (m, 2 H), 1.90-2.05 (m, 2 H), 2.70-3.50 (m, 5 H), 3.80-4.10 (m, 5 H), 6.90 (d, J = 6.7 Hz, 2 H), 6.77 (d, J = 6.7 Hz, 2 H), 7.02 (d, J = 8.9 Hz, 2 H), 7.35 (s, 1 H), 7.39 (d, J = 8.9 Hz, 2 H), 8.95 (brs, 1 H); MS (ES) m/z: 469.9 (MH⁺); HRMS Calcd. for C₂₄H₂₈N₃O₅S (M⁺): 469.1671.
30 Found: 469.1648.

EXAMPLE 77

N-[5-(2-{1-[4-(2,4-Dioxo-thiazolidin-5-ylidenemethyl)phenyl]piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide

The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzylidene]-thiazolidine-2,4-dione (which was obtained in Example 36) and N-[5-(2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 9) according to the procedure of Example 73 as a pale yellowish solid; mp >200 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.45-1.60 (m, 2 H), 1.90-2.05 (m, 2 H), 2.70-3.50 (m, 5 H), 2.94 (s, 3 H), 3.88 (brd, J = 9.9 Hz, 2 H), 4.67 (dd, J = 7.2, 2.1 Hz, 1 H), 6.87 (d, J = 6.3 Hz, 1 H), 7.00 (d, J = 6.8 Hz, 2 H), 7.06 (dd, J = 6.3, 1.5 Hz, 1 H), 7.23 (d, J = 1.5 Hz, 1 H), 7.33 (s, 1 H), 7.38 (d, J = 6.8 Hz, 2 H); MS (ES) m/z: 533.0 (MH⁺); HRMS Calcd. for C₂₄H₂₉N₄O₆S₂ (MH⁺): 533.1529. Found: 533.1544.

EXAMPLE 78

N-[5-(2-{1-[4-(2,4-Dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide

The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 38) and N-[5-(2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 9) according to the procedure of Example 73 as a pale yellowish solid; mp >150 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.60 (m, 2 H), 1.90-2.10 (m, 2 H), 2.55-3.60 (m, 7 H), 2.93 (s, 3 H), 3.67 (brd, J = 12.8 Hz, 2 H), 4.56 (dd, J = 9.6, 4.0 Hz, 1 H), 4.64 (brd, J = 6.5 Hz, 1 H), 6.70-6.95 (m, 3 H), 6.95-7.15 (m, 3 H), 7.22 (d, J = 2.1 Hz, 1 H); MS (ES) m/z: 535.0 (MH⁺); HRMS Calcd. for C₂₄H₃₁N₄O₆S₂ (MH⁺): 535.1685. Found: 535.1720.

EXAMPLE 79

5-(4-[4-[2-(3-Chloro-phenyl)-(2R)-2-hydroxyethylamino]-piperidin-1-yl]-benzyl)-thiazolidine-2,4-dione

The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 38) and (1R)-2-amino-1-(3-chloro-phenyl)-ethanol (which was obtained in Example 1) according to the procedure of Example 73 as a pale yellowish solid; mp >195-198 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.60 (m, 2 H), 1.85-2.10 (m, 2 H), 2.60-3.50 (m, 7 H), 3.65 (brd, J = 12.5 Hz, 2 H), 4.63 (dd, J = 9.5, 4.1 Hz, 1 H), 4.74 (dd, J = 8.8, 3.1 Hz, 1 H), 6.86 (d, J = 8.7 Hz, 2 H), 7.05 (d, J = 8.7 Hz, 2 H), 7.20-7.50

(m, 4 H); MS (ES) m/z: 460.0 (MH⁺); HRMS Calcd. for C₂₃H₂₆ClN₃O₃S (M⁺): 459.1383. Found: 459.1376.

EXAMPLE 80

5 5-(4-{4-[(2S)-2-Hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)-propylamino]-
piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione

The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 38) and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) according to the procedure of Example 73 as a pale yellowish solid; mp 173-175 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.45-1.60 (m, 2 H), 1.90-2.15 (m, 2 H), 2.10-2.95 (m, 5 H), 3.03 (brd, J = 10.5 Hz, 1 H), 3.26 (dd, J = 14.1, 3.8 Hz, 1 H), 3.68 (brd, J = 12.4 Hz, 2 H), 3.95-4.05 (m, 3 H), 4.51 (dd, J = 10.0, 4.0 Hz, 1 H), 6.58 (d, J = 7.8 Hz, 1 H), 6.63 (d, J = 8.1 Hz, 1 H), 6.75-6.95 (m, 3 H), 7.05 (d, J = 8.7 Hz, 2 H), 11.60 (s, 1 H), 11.85 (brs, 1 H); MS (ES) m/z: 512.0 (MH⁺); HRMS Calcd. for C₂₅H₃₀N₅O₅S (MH⁺): 512.1968. Found: 512.1982.

The free base from above was dissolved in 20 mL of concentrated hydrochloric acid and stirred for 1 hour. The solvent was removed and the residue was dissolved in methanol. Upon addition of diethyl ether the solid which was formed was collected to give 5-(4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)propylamino]piperidin-1-yl}benzyl)thiazolidine-2,4-dione dihydrochloride salt as a pale yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.80-2.10 (m, 2 H), 2.10-2.30 (m, 2 H), 2.90-4.30 (m, 12 H), 4.90 (dd, J = 9.0, 3.0 Hz, 1 H), 6.60 (d, J = 6.0 Hz, 1 H), 6.64 (d, J = 6.0 Hz, 1 H), 6.88 (t, J = 6.0 Hz, 1 H), 7.10-7.40 (m, 4 H), 8.90 (brs, 1 H), 9.21 (brs, 1 H), 10.62 (s, 1 H), 10.75 (s, 1 H), 12.04 (s, 1 H); MS (ES) m/z: 512.0 (M-2HCl+H)⁺; HRMS Calcd. for C₂₅H₃₀N₅O₅S (M-2 HCl+H)⁺: 512.1968. Found: 512.1964.

EXAMPLE 81

30 5-(4-{4-[(2S)-2-Hydroxy-3-(4-hydroxy-phenoxy)-propylamino]-piperidin-1-yl}-benzyl)-
thiazolidine-2,4-dione

The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 38) and 4-[(2S)-3-amino-2-hydroxy-propoxy]-phenol (which was obtained in Example 5) according to the procedure of Example 73 as a pale yellowish solid; mp >160 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.35-1.60 (m,

2 H), 1.85-2.05 (m, 2 H), 2.60-3.50 (m, 7 H), 3.67 (brd, J = 12.1 Hz, 2 H), 3.75-3.95 (m, 3 H), 4.57 (dd, J = 9.6, 3.8 Hz, 1 H), 6.66 (d, J = 8.9 Hz, 2 H), 6.77 (d, J = 8.9 Hz, 2 H), 6.85 (d, J = 8.6 Hz, 2 H), 7.03 (d, J = 8.6 Hz, 2 H), 8.92 (brs, 1 H); MS (ES) m/z: 472.0 (MH⁺); HRMS Calcd. for C₂₄H₃₀N₃O₅S (MH⁺): 472.1906. Found: 472.1898.

5

EXAMPLE 82

5-[4-[4-[(2S)-2-Hydroxy-3-(4-hydroxy-phenoxy)-propylamino]-piperidin-1-yl]-benzylidene]-2-thioxo-thiazolidin-4-one

10 The title compound was prepared from 1-[4-(4-oxo-2-thioxo-thiazolidin-5-ylidene-methyl)-phenyl]-piperidin-4-one (which was obtained in Example 34) and 4-[(2S)-3-amino-2-hydroxy-propoxy]-phenol (which was obtained in Example 5) according to the procedure of Example 73 as a pale yellowish solid; MS (ES) m/z: 485.9 (MH⁺).

EXAMPLE 83

15 5-[4-[4-[(2S)-2-Hydroxy-3-phenoxy-propylamino]-piperidin-1-yl]-benzylidene]-thiazolidine-2,4-dione

20 The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzylidene]-thiazolidine-2,4-dione (which was obtained in Example 36) and (2S)-1-amino-3-phenoxy-propan-2-ol (which was obtained in Example 3) according to the procedure of Example 73 as a pale yellowish solid; mp 208-210 °C; MS (ES) m/z: 454.0 (MH⁺); HRMS Calcd. for C₂₄H₂₇N₃O₄S (M⁺): 453.1723. Found: 453.1710.

EXAMPLE 84

25 N-[5-[(2R)-2-{1-[4-(2,4-Dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl]-2-hydroxy-phenyl]-methanesulfonamide

30 The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 38) and N-[5-(2-amino-(1R)-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 73 as a pale yellowish solid; mp >180 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.65 (m, 2 H), 1.90-2.10 (m, 2 H), 2.55-3.60 (m, 7 H), 2.94 (s, 3 H), 3.61 (brd, J = 9.6 Hz, 2 H), 4.61 (dd, J = 9.7, 4.0 Hz, 1 H), 4.69 (dd, J = 9.1, 2.7 Hz, 1 H), 6.70-6.90 (m, 3 H), 7.00-7.15 (m, 3 H), 7.23 (d, J = 2.1 Hz, 1 H); MS (ES) m/z: 535.0 (MH⁺); HRMS Calcd. for C₂₄H₃₁N₄O₆S₂ (MH⁺): 535.1685. Found: 535.1692.

The free base (0.15 g) prepared above was dissolved in 30 mL of MeOH/CH₂Cl₂ (1/4) and treated with hydrogen chloride gas for 10 minutes. Diethyl ether was then added and the solid which was formed was collected to give N-[5-((2R)-2-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide dihydrochloride salt as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.80-2.10 (m, 2 H), 2.15-2.30 (m, 2 H), 2.95-4.00 (m, 10 H), 2.95 (s, 3 H), 4.89 (dd, J = 6.9, 3.0 Hz, 1 H), 6.94 (d, J = 6.0 Hz, 1 H), 7.10 (dd, J = 6.0, 3.0 Hz, 1 H), 7.10-7.30 (m, 5 H), 8.79 (s, 1 H), 8.85 (brs, 1 H), 9.32 (brs, 1 H), 10.02 (brs, 1 H), 12.05 (s, 1 H); MS (ES) m/z: 535.0 (M-2HCl+H)⁺; HRMS Calcd. for C₂₄H₃₁N₄O₆S₂ (M-2HCl+H)⁺: 535.1685. Found: 535.1715.

EXAMPLE 85

N-[5-(2-{1-[4-(2,5-Dioxo-imidazolidin-4-ylidenemethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide

The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzylidene]-imidazolidine-2,4-dione (which was obtained in Example 42) and N-[5-(2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 9) according to the procedure of Example 73 as a pale yellowish solid; mp >201 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.75-1.95 (m, 2 H), 2.50-2.90 (m, 5 H), 2.92 (s, 3 H), 3.70-3.85 (m, 2 H), 4.48 (dd, J = 8.0, 4.2 Hz, 1 H), 6.33 (s, 1 H), 6.81 (d, J = 8.1 Hz, 1 H), 6.95 (d, J = 8.7 Hz, 2 H), 7.02 (dd, J = 8.1, 1.8 Hz, 1 H), 7.18 (d, J = 61.8 Hz, 1 H), 7.47 (d, J = 8.7 Hz, 2 H); MS (ES) m/z: 516.1 (MH⁺); HRMS Calcd. for C₂₄H₃₀N₅O₆S (MH⁺): 516.1917. Found: 516.1922.

EXAMPLE 86

5-(4-[4-[2-Hydroxy-3-(2-oxo-2,3-dihydro-1H-benzimidazol-4-yloxy)-propylamino]-piperidin-1-yl]-benzyl)-imidazolidine-2,4-dione-piperidin-1-yl)-benzyl imidazolidine-2,4-dione

The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzyl]-imidazolidine-2,4-dione (which was obtained in Example 44) and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) according to the procedure of Example 73 as a pale yellowish solid; mp >132 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.80-1.95 (m, 2 H), 2.50-2.85 (m, 8 H), 3.50-3.65 (m, 2 H), 3.75-4.05 (m, 3 H), 4.22 (t, J = 4.6 Hz, 1 H), 6.57 (d, J = 7.5 Hz, 1 H), 6.62 (d, J = 8.1 Hz, 1 H), 6.80-6.90 (m, 3 H), 6.99 (d, J = 8.4 Hz, 2 H), 7.87 (s, 1 H), 10.50 (s, 1 H), 10.70 (brs, 1 H); MS (ES) m/z: 495.1 (MH⁺); HRMS Calcd. for C₂₅H₃₁N₆O₅ (M⁺): 495.2356. Found: 495.2368.

EXAMPLE 87

N-[5-(2-{1-[4-(2,5-Dioxo-imidazolidin-4-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide

- 5 The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzyl]-imidazolidine-2,4-dione (which was obtained in Example 44) and N-[5-(2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 9) according to the procedure of Example 73 as a pale yellowish solid; mp >105 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.80-2.00 (m, 2 H), 2.50-2.75 (m, 5 H), 2.86 (d, J = 4.8 Hz, 2 H), 2.93 (s, 3 H), 3.50-3.65 (m, 2 H), 4.24 (t, J = 4.8 Hz, 1 H), 4.51 (dd, J = 8.2, 4.0 Hz, 1 H), 6.81 (d, J = 6.3 Hz, 1 H), 6.84 (d, J = 5.7 Hz, 2 H), 7.18 (d, J = 1.8 Hz, 1 H), 7.85 (brs, 1 H); MS (ES) m/z: 518.0 (MH⁺); HRMS Calcd. for C₂₄H₃₂N₅O₆S (MH⁺): 518.2073. Found: 518.2056.
- 10

EXAMPLE 88

- 15 N-[2-Hydroxy-5-(1-hydroxy-2-{1-[4-(2-imino-4-oxo-thiazolidin-5-ylidenemethyl)-phenyl]-piperidin-4-ylamino}-ethyl)-phenyl]-methanesulfonamide

- The title compound was prepared from 1-[4-(2-imino-4-oxo-thiazolidin-5-ylidenemethyl)-phenyl]-piperidin-4-one (which was obtained in Example 43) and N-[5-(2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 9) according to the procedure of Example 73 as a pale yellowish solid; mp >210 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.80-2.00 (m, 2 H), 2.50-3.00 (m, 5 H), 2.92 (s, 3 H), 3.70-3.90 (m, 2 H), 4.47 (dd, J = 7.9, 4.4 Hz, 1 H), 6.81 (d, J = 8.3 Hz, 1 H), 6.90-7.10 (m, 3 H), 7.18 (d, J = 2.0 Hz, 2 H), 7.39 (d, J = 8.9 Hz, 2 H), 7.47 (s, 1 H); MS (ES) m/z: 532.0 (MH⁺); HRMS Calcd. for C₂₄H₃₀N₅O₅S₂ (MH⁺): 532.1688. Found: 532.1672.
- 20

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EXAMPLE 89

4-((2S)-2-Hydroxy-3-{1-[4-(2-imino-4-oxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-propoxy)-1,3-dihydro-benzoimidazol-2-one

- The title compound was prepared from 1-[4-(2-imino-4-oxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-one (which was obtained in Example 45) and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) according to the procedure of Example 73 as a pale yellowish solid; mp >155 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.80-1.95 (m, 2 H), 2.50-2.90 (m, 6 H), 3.24 (dd, J = 14.1, 4.0 Hz, 1 H), 3.50-3.75 (m, 2 H), 3.80-4.05 (m, 3 H), 4.50 (dd, J = 9.8, 4.0 Hz, 1 H), 4.88
- 30

(brs, 1 H), 6.57 (d, J = 7.8 Hz, 1 H), 6.62 (d, J = 8.1 Hz, 1 H), 6.80-6.90 (m, 3 H), 7.04 (d, J = 8.7 Hz, 2 H), 8.73 (brs, 1 H); MS (ES) m/z: 256.3 ((M+2H)²⁺, 100%), 511.2 (MH⁺, 10%); HRMS Calcd. for C₂₅H₃₁N₆O₄S (MH⁺): 511.2128. Found: 511.2122.

5 EXAMPLE 90

N-[2-Hydroxy-5-(1-hydroxy-2-{1-[4-(2-imino-4-oxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-ethyl)-phenyl]-methanesulfonamide

The title compound was prepared from 1-[4-(2-imino-4-oxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-one (which was obtained in Example 45) and N-[5-(2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 9) according to the procedure of Example 73 as a pale yellowish solid; mp >90 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.80-2.00 (m, 2 H), 2.50-2.80 (m, 6 H), 2.93 (s, 3 H), 3.25 (dd, J = 14.2, 3.9 Hz, 1 H), 3.45-3.60 (m, 2 H), 4.40-4.55 (m, 2 H), 6.81 (d, J = 8.3 Hz, 1 H), 6.88 (d, J = 8.6 Hz, 2 H), 6.96 (dd, J = 8.3, 2.0 Hz, 1 H), 7.04 (d, J = 8.6 Hz, 2 H), 7.16 (d, J = 2.0 Hz, 1 H); MS (ES) m/z: 267.7 ((M+2H)²⁺, 100%), 534.3 (MH⁺, 45%), 1067.0 (2MH⁺, 2%); HRMS Calcd. for C₂₄H₃₂N₅O₅S₂ (MH⁺): 534.1845. Found: 534.1850.

EXAMPLE 91

5-(4-{4-[(2S)-2-Hydroxy-3-(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-quinolin-5-yloxy)-propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione

The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 38) and (S)-5-(3-amino-2-hydroxy-propoxy)-8-hydroxy-3,4-dihydro-1H-quinolin-2-one (which was obtained in Example 12) according to the procedure of Example 73 as a pale yellowish solid; mp >140 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.55 (m, 2 H), 1.85-2.00 (m, 2 H), 2.40 (t, J = 8.0 Hz, 2 H), 2.60-3.00 (m, 8 H), 3.25 (dd, J = 15.9, 3.9 Hz, 1 H), 3.50-3.70 (m, 2 H), 3.80-4.00 (m, 3 H), 4.50 (dd, J = 9.7, 3.9 Hz, 1 H), 6.34 (d, J = 8.9 Hz, 1 H), 6.61 (d, J = 8.9 Hz, 1 H), 6.85 (d, J = 8.6 Hz, 2 H), 7.05 (d, J = 8.6 Hz, 2 H), 8.76 (s, 1 H), 9.24 (brs, 1 H); MS (ES) m/z: 541.1 (MH⁺); HRMS Calcd. for C₂₇H₃₃N₄O₆S (MH⁺): 541.2121. Found: 541.2148.

EXAMPLE 92

N-[5-((2S)-3-{1-[4-(2,4-Dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-2-hydroxy-propoxy)-2-hydroxy-phenyl]-methanesulfonamide

The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 38) and N-[5-((2S)-3-amino-2-hydroxy-propoxy)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 14) according to the procedure of Example 73 as a grey solid; mp >70 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.45-1.55 (m, 2 H), 1.85-2.00 (m, 2 H), 2.60-2.90 (m, 6 H), 2.94 (s, 3 H), 3.23 (dd, J = 14.0, 3.8 Hz, 1 H), 3.60-4.00 (m, 5 H), 4.49 (dd, J = 8.8, 3.9 Hz, 1 H), 6.64 (dd, J = 8.8, 3.0 Hz, 1 H), 6.75-6.90 (m, 4 H), 7.04 (d, J = 8.6 Hz, 2 H); MS (ES) m/z: 564.8 (MH⁺, 100%); HRMS Calcd. for C₂₅H₃₃N₄O₇S₂ (MH⁺): 565.1791. Found: 565.1783.

EXAMPLE 93

N-[5-((2S)-3-{1-[4-(2,4-Dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-2-hydroxy-propoxy)-2-hydroxy-phenyl]- benzenesulfonamide

The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 38) and N-[5-(3-amino-2-hydroxy-propoxy)-2-hydroxy-phenyl]- benzenesulfonamide (which was obtained in Example 21) according to the procedure of Example 73 as an off-white solid; mp >120 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.30-1.55 (m, 2 H), 1.80-2.00(m, 2 H), 2.50-4.00(m, 12 H), 4.55(dd, J = 9.6, 4.0 Hz, 1 H), 6.49(dd, J = 8.7, 2.9 Hz, 1 H), 6.61(d, J = 8.7 Hz, 1 H), 6.77(d, J = 2.9 Hz, 1 H), 6.86(d, J = 8.7 Hz, 2 H), 7.05(d, J = 8.7 Hz, 2 H), 7.40-7.60(m, 3 H), 7.70-7.80(m, 2 H); MS (ES) m/z: 627.0 (MH⁺, 100%); HRMS Calcd. for C₃₀H₃₅N₄O₇S₂ (MH⁺): 627.1941. Found: 627.1954.

EXAMPLE 94

(R)-Propane-2-sulfonic acid [5-(2-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy- phenyl]-amide

The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 38) and propane-2-sulfonic acid [5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy- phenyl]-amide(which was obtained in Example 27) according to the procedure of Example 73 as a white solid; mp >175 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.25(d, J = 6.8 Hz, 6 H), 1.30-1.55 (m, 2 H), 1.80-2.00(m, 2 H), 2.60-3.70(m, 9 H), 4.47(dd, J = 9.7, 3.9 Hz, 1 H), 4.58(dd, J = 8.7, 3.4 Hz, 1 H), 6.75-6.90(m, 3 H), 6.90-7.10(m, 3

H), 7.26(d, J = 2.0 Hz, 1 H); MS (ES) m/z: 563.0 (MH⁺, 100%); HRMS Calcd. for C₂₆H₃₅N₄O₆S₂ (MH⁺): 563.1992. Found: 563.1985.

EXAMPLE 95

5 N-[2-Chloro-5-((1R)-2-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-phenyl]-methanesulfonamide

To a stirred mixture of copper(II) sulfate pentahydrate (0.042g, 0.17 mmol) in N,N-dimethylformamide (15 mL) was added sodium borohydride (0.037 g, 1 mmol). To the resulting suspension was added N-[5-((1R)-2-azido-1-hydroxy-ethyl)-2-chloro-phenyl]-methanesulfonamide (which was obtained in Example 25)(0.11g, 0.38 mmol). After stirring for 20 minutes more copper(II) sulfate pentahydrate (0.042g, 0.17 mmol) and sodium triacetoxyborohydride (0.064g, 0.3 mmol) was added. The reaction mixture was stirred for 2.5 hours and then 5-[4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 38) (0.116 mg, 0.38 mmol), sodium triacetoxyborohydride (0.212g, 1.0 mmol), and acetic acid (0.2 mL) were added. After stirring for 1.5 hours aqueous sodium bicarbonate solution was added and the resulting solid was collected. The product was purified by flash silica gel chromatography eluting with methylene chloride and methanol to give the title compound as a pale grey solid; mp >105 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.30-1.50(m, 2 H), 1.80-2.00(m, 2 H), 2.60-3.60(m, 9 H), 3.00(s, 3 H), 4.40-4.55(m, 1 H), 4.65-4.75(m, 1 H), 6.84(d, J = 8.4 Hz, 2 H), 7.04(d, J = 8.4 Hz, 1 H), 7.20(d, J = 8.1 Hz, 1 H), 7.40-7.50(m, 2 H); MS (ES) m/z: 553.2 (MH⁺, 100%); HRMS Calcd. for C₂₄H₃₀ClN₄O₅S₂ (MH⁺): 553.1440. Found: 553.1336.

EXAMPLE 96

25 N-(5-((1R)-2-[(1-[4-[(2,4-Dioxo-1,3-thiazolidin-5-yl)methyl]phenyl]piperidin-4-yl)amino]-1-hydroxyethyl)-2-hydroxyphenyl)benzenesulfonamide

The title compound was prepared from 5-[4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 38) and N-[5-((R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-phenylsulfonamide (which was obtained in Example 32) according to the procedure of Example 73 as a white solid; mp >150 °C (decomposed); ¹H NMR (300 MHz, DMSO- d₆) δ 1.39(m, 4 H), 1.85(m, 4 H), 2.64 (m, 2 H), 2.89(s, 3 H), 4.48(m, 1 H), 6.67(d, J = 6 Hz, 1 H), 6.86(m, 2 H), 7.02(m, 2 H), 7.48(m, 2 H), 7.72(d, J = 6 Hz, 1 H); MS (ES) m/z: 597.0 (MH⁺, 100%); HRMS Calcd. for C₂₉H₃₂N₄O₆S₂(MH⁺): 597.1836. Found: 597.1827.

EXAMPLE 97

N-[2-Hydroxy-5-(1-hydroxy-2-{1-[4-(1H-tetrazol-5-yl)-phenyl]-piperidin-4-ylamino}-ethyl)phenyl]-methanesulfonamide

The title compound was prepared from 1-[4-(1H-tetrazol-5-yl)-phenyl]-piperidin-4-one (which was obtained in Example 47) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 73 as a white solid; mp >175 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.65 (m, 2 H), 1.90-2.10 (m, 2 H), 2.70-3.10 (m, 5 H), 2.95 (s, 3 H), 3.70-3.85 (m, 2 H), 4.69 (dd, J = 9.3, 3.0 Hz, 1 H), 6.89 (d, J = 8.3 Hz, 1 H), 6.97 (d, J = 8.9 Hz, 2 H), 7.06 (dd, J = 8.3, 2.0 Hz, 1 H), 7.24 (d, J = 2.0 Hz, 1 H), 7.80 (d, J = 8.9 Hz, 2 H); MS (ES) m/z: 474.1 (MH⁺); HRMS Calcd. for C₂₁H₂₈N₇O₄S (MH⁺): 474.1918. Found: 474.1912.

EXAMPLE 98

Ethyl [5-(4-{4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino]-1-piperidinyl}phenyl)-1H-tetraazol-1-yl] acetate

The title compound was prepared from ethyl{5-[4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)phenyl]-1H-tetraazol-1-yl}acetate (which was obtained in Example 48) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedures of Example 34 and Example 73 as a white solid; mp >140 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.17 (t, J = 7.1 Hz, 3 H), 1.20-1.40 (m, 2 H), 1.80-1.95 (m, 2 H), 2.50-3.50 (m, 5 H), 2.89 (s, 3 H), 3.70-3.90 (m, 2 H), 4.11 (q, J = 7.1 Hz, 2 H), 4.47 (dd, J = 7.8, 4.4 Hz, 1 H), 5.60 (brs, 2 H), 6.79 (d, J = 8.2 Hz, 1 H), 6.96 (dd, J = 8.2, 2.0 Hz, 1 H), 7.07 (d, J = 8.9 Hz, 2 H), 7.16 (d, J = 2.0 Hz, 1 H), 7.56 (d, J = 8.9 Hz, 2 H); MS (ES) m/z: 560.2 (MH⁺); HRMS Calcd. for C₂₁H₂₈N₇O₄S (MH⁺): 560.2286. Found: 560.2282.

EXAMPLE 99

[5-(4-{4-(((2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino]-1-piperidinyl}phenyl)-1H-tetraazol-1-yl] acetic acid

The title compound was prepared from ethyl [5-(4-{4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino]-1-piperidinyl}phenyl)-1H-tetraazol-1-yl] acetate (which was obtained in Example 98) by NaOH hydrolysis as an off-white solid; mp >210 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.30-1.50 (m, 2 H), 1.80-2.00 (m, 2 H), 2.60-3.50 (m, 5 H), 2.92 (s, 3 H), 3.70-3.85 (m, 2 H), 4.50-4.60 (m, 1 H), 4.70-4.80 (m, 2 H), 6.84 (d,

J = 8.2 Hz, 1 H), 6.95-7.05 (m, 3 H), 7.20 (d, J = 1.6 Hz, 1 H), 7.66 (d, J = 8.7 Hz, 2 H); MS (ES) m/z: 530.2 (M-H)⁻; HRMS Calcd. for C₂₁H₂₈N₇O₄S (M-H)⁻: 530.1827. Found: 530.1827.

EXAMPLE 100

5 [5-(4-{4-[(2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl)-2H-tetraazol-2-yl]acetic acid

The title compound was prepared from ethyl{5-[4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)-phenyl]-2H-tetraazol-2-yl}acetate (which was obtained in Example 48) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedures of Example 98 and Example 99 as a white solid; mp >240 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.45-1.65 (m, 2 H), 1.90-2.10 (m, 2 H), 2.50-3.10 (m, 5 H), 2.95 (s, 3 H), 3.65-3.85 (m, 2 H), 4.89 (brd, J = 8.3 Hz, 1 H), 5.08 (d, J = 15.9 Hz, 1 H), 5.15 (d, J = 15.9 Hz, 1 H), 6.88 (d, J = 8.3 Hz, 1 H), 6.95 (d, J = 8.7 Hz, 2 H), 7.09 (dd, J = 8.3, 2.0 Hz, 1 H), 7.26 (d, J = 2.0 Hz, 1 H), 7.87 (d, J = 8.7 Hz, 2 H); MS (ES) m/z: 532.1 (MH⁺); HRMS Calcd. for C₂₁H₃₀N₇O₄S (MH⁺): 532.1973. Found: 532.1965.

EXAMPLE 101

Trifluoromethylthioacetamide

A mixture of trifluoroacetamide (45.2 g, 0.4 mol), Lawesson's Reagent (2,4-bis(4-methoxyphenyl)-1,3-thia-2,4-diphosphetane-2,4-disulfide) (81.7 g, 0.202 mol) and benzene (600 mL) was refluxed for 20 hours. The volatiles were removed in vacuo and the residue was purified by silica gel filtration (hexanes/dichloromethane 1/1) to give light yellow solid (24 g, 47 % yield); MS (ES) m/z: 130 (MH⁺); ¹H NMR (300 MHz, DMSO-d₆) δ 6.90 (d, 1H), 7.60 (d, 1H).

EXAMPLE 102

2-Bromo-1-[2-(trifluoromethyl)-1,3-thiazole-4-yl]ethanone

A solution of trifluoromethylthioacetamide (which was obtained in Example 101) (14 g, 0.11 mol) in acetonitrile (200 mL) was added dropwise into a boiling solution of 1,4-dibromo-2,3-butanedione (26.4 g, 0.11 mol) in acetonitrile (200 mL) over a period of 2.5 hours. The volatiles were removed in vacuo and the residue was purified by flash chromatography (hexanes/toluene 6/4) to give a light pink colored solid (7.0 g, 24 % yield); mp 36-37° C; MS (ES) m/z: 273 (M-H)⁻; ¹H NMR (400 MHz, CDCl₃) δ 4.64 (s, 2H), 8.50 (s, 1H).

EXAMPLE 103(1S)-2-Bromo-1-[2-(trifluoromethyl)-1,3-thiazole-4-yl]ethanol

Borane (in THF, 1M, 10.35 mL, 10.5 mmol) was added dropwise into a mixture of (R)-2-methyl-CBS-oxazaborolidine monohydrate (0.38g, 1.31) mmol and tetrahydrofuran (15 mL) under a nitrogen atmosphere at ambient temperature. The mixture was stirred for 10 minutes and then 2-bromo-1-[2-(trifluoromethyl)-1,3-thiazole-4-yl]ethanone (which was obtained in Example 102)(3.6 g, 13.13 mmol) in tetrahydrofuran (20 mL) was added dropwise over 10 minutes. The new mixture was stirred at room temperature for 4 hours. The reaction mixture was cooled to 0° C and quenched with a hydrogen chloride/ethyl ether solution (1M, 1.0 mL). After stirring at 0° C for 30 minutes, H₂O (20 mL) was added dropwise and the mixture was extracted with ethyl ether. The organic layer was washed with aqueous ammonium chloride and dried over MgSO₄. Evaporation and purification by flash chromatography (hexanes/dichloromethane/ethanol 1/1/0.01) gave a clear oil (2.4 g, 66% yield); MS (ES) m/z: 334/336 (M+acetic acid-H)⁻; ¹H NMR (400 MHz, CDCl₃) δ 2.94 (m, 1H), 3.74 (m, 1H), 3.94 (m, 1H), 5.16 (m, 1H), 7.62 (s, 1H).

EXAMPLE 1044-[(2S)-Oxiran-2-yl]-2-trifluoromethyl-1,3-thiazole

Aqueous sodium hydroxide (5N, 11 mL) was added to a solution of (1S)-2-bromo-1-[2-(trifluoromethyl)-1,3-thiazole-4-yl]ethanol (which was obtained in Example 103)(1.52 g, 5.5 mmol) in tetrahydrofuran (6 mL). The mixture was stirred at room temperature for 18 hours. The reaction mixture was diluted with H₂O (30 mL) and extracted with dichloromethane. The organic extracts were washed with H₂O and brine, and dried over MgSO₄. Evaporation and purification by flash chromatography (hexanes/dichloromethane 6/4) gave a clear oil (1.33 g, 74% yield); MS (ES) m/z: 196 (MH⁺); ¹H NMR (400 MHz, CDCl₃) δ 3.09 (m, 1H), 3.19(m, 1H), 4.11(m, 1H), 7.48 (s, 1H).

EXAMPLE 105(1S)-(2-Amino-1-[2-trifluoromethyl]-1,3-thiazole-4-yl]ethanol

Ammonia (20 g) was bubbled over 1 hour into a cold (-40°C) pressure vessel containing 4-[(2S)-oxiran-2-yl]-2-trifluoromethyl-1,3-thiazole(which was obtained in Example 104)(0.13 g, 6.8 mmol) and methyl alcohol (40 mL). The reaction vessel was sealed, warmed up to room temperature and stirred for 48 hours. The methyl alcohol was removed in vacuo and the product was purified by flash chromatography (chloroform/methyl alcohol/triethylamine

8/2/0.01) to give a white solid (0.65 g, 45 % yield); MS (ES) m/z: 213 (MH⁺); ¹H NMR (400 MHz, CDCl₃) δ 3.05 (m, 1H), 3.21(m, 1H), 4.85(m, 1H), 7.55 (s, 1H).

EXAMPLE 106

5 5-{4-[4-((2S)-2-Hydroxy-2-[2-(trifluoromethyl)-1, 3-thiazol-4-yl]ethyl)amino)piperidine-1-yl]-benzyl}-1, 3-thiazolidine-2, 4-dione

A mixture of (1S)-(2-amino-1-[2-trifluoromethyl]-1, 3-thiazole-4-yl]ethanol (which was obtained in Example 105)(0.34 g, 1.59 mmol) and 5-[4-(4-oxopiperidine-1-yl)benzyl]-1,3-thiazolidine-2,4-dione (which was obtained in Example 38)(0.48 g, 1.59 mmol), sodium triacetoxymethylborohydride (0.67 g, 3.18 mmol), and acetic acid (0.33 mL) in N,N-dimethylformamide (15 mL) was stirred at room temperature for 18 hours, poured into aqueous ammonium chloride and extracted with ethyl acetate. The organic extracts were washed with brine and dried over MgSO₄. Evaporation and purification by flash chromatography (chloroform/methyl alcohol 9.5/5) gave a yellow solid (0.1g, 13 % yield); mp 108-113 °C; MS
10 (ES) m/z: 501 (MH⁺); ¹H NMR (400 MHz, DMSO-d₆) δ 1.44 (m, 2H), 1.93 (s, 2H), 3.23-2.66 (m, 7H), 3.62 (d, 2H), 4.68 (m, 1H), 4.94 (m, 1H), 6.86 (d, 2H), 7.5 (d, 2H), 8.3 (s, 1H);
15 Anal. Calcd. for C₂₁H₂₃F₃N₄O₃S₂: C, 50.39; H, 4.63; N, 11.19. Found: C, 50.16; H, 5.16; N, 9.93.

20 EXAMPLE 107

(1S)-2-Bromo-1-[3-(3,4-dichlorophenyl)isoxazol-5-yl]methanol

The title compound was prepared from 5-(bromoacetyl)-3-(3,4-dichlorophenyl)isoxazole, 1M BH₃/THF, and (R)-2-methyl-CBS-oxazaborolidine monohydrate in substantially the same manner as described in Example 103 and was obtained as a white solid (4.5 g, 89 %
25 yield), mp 103-104 °C; MS m/z: 335 (M⁺); ¹H NMR (400 MHz, DMSO-d₆) δ 3.76 (m, 2H), 5.05 (m, 1H), 6.50 (d, 1H), 7.17 (s, 1H), 7.90 (d, 1H), 7.92 (d, 1H), 8.34 (s, 1H).

EXAMPLE 108

3-(3,4-Dichlorophenyl)-5-[(2S)-oxiran-2-yl]isoxazole

30 The title compound was prepared from (1S)-2-bromo-1-[3-(3,4-dichlorophenyl)isoxazol-5-yl]methanol (which was obtained in Example 107), in aqueous sodium hydroxide (5N) in substantially the same manner as described in Example 104 and was obtained as a white solid (1.6 g, 84 % yield); mp 74 °C; MS (ES) m/z: 256 (MH⁺); ¹H NMR (400 MHz, CDCl₃) δ 3.25 (m, 2H), 4.04 (d, 1H), 6.54 (s, 1H), 7.54 (d, 1H), 7.62 (d, 1H), 7.89 (s, 1H).

EXAMPLE 109

(1S)-2-Amino-1-[3-(3,4-dichlorophenyl)isoxazol-5-yl]ethanol

The title compound was prepared from 3-(3,4-dichlorophenyl)-5-[(2S)-oxiran-2-yl]-isoxazole (which was obtained in Example 108), in methyl alcohol and ammonia in substantially the same manner as described in Example 105, and was obtained as a white solid (0.43 g, 80 % yield), mp 105 °C; MS (ES) m/z: 273 (MH⁺); ¹H NMR (400 MHz, CDCl₃) δ 3.18 (m, 2H), 4.83 (m, 1H), 6.56 (s, 1H), 7.54 (d, 1H), 7.62 (d, 1H), 7.90 (s, 1H).

EXAMPLE 110

5-[4-[4-[(2S)-2-[3-(3,4-Dichlorophenyl)isoxazol-5-yl]-2-hydroxyethyl]-amino]piperidin-1-yl]-benzyl]-1,3-thiazole-2,4-dione

The title compound was prepared from (1S)-2-amino-1-[3-(3,4-dichloro-phenyl)isoxazol-5-yl]ethanol (which was obtained in Example 109) and 5-[4-(4-oxopiperidine-1-yl)benzyl]-1,3-thiazolidine-2,4-dione (which was obtained in Example 38) in substantially the same manner, as described in Example 106 and was obtained as a white solid (0.22 g, 48 % yield), mp 110 °C; MS (ES) m/z: 561 (MH⁺); ¹H NMR (400 MHz, DMSO-d₆) δ 1.38 (m, 2H), 1.89 (m, 2H), 3.32-2.67 (m, 7H), 3.60 (m, 2H), 4.74 (m, 1H), 4.85 (m, 1H), 6.85 (d, 1H), 7.02 (d, 1H), 7.11 (s, 1H), 7.79 (d, 1H), 7.86 (d, 1H), 8.13 (s, 1H).

EXAMPLE 111

N-[4-(2-Bromoacetyl)phenyl]methanesulfonamide

A solution of bromine (0.73 mL, 14.06 mmol) in methylene chloride (5 mL) was added at room temperature over 10 minutes to a mixture of N-[4-(2-bromoacetyl)phenyl]-methanesulfonamide (Uloth, R. H. et al. *J. Med. Chem.*, **1966**, 88-97) (2.41 g, 8.25 mmol), (R)-2-methyl-CBS-oxazaborolidine monohydrate (3g, 14.06 mmol), benzoylperoxide (0.05 g), and methylene chloride (40 mL). The new mixture was stirred for 60 hours. The precipitate was collected, washed with ethyl ether and crystallized from ethanol to give an off-white solid (2.5 g, 60 % yield); MS (ES) m/z: 291 (M)⁺; ¹H NMR (400 MHz, DMSO-d₆) δ 3.14 (s, 3H), 4.82 (s, 2H), 7.25 (d, 2H), 7.95 (d, 2H), 10.21 (s, 1H); Anal. Calcd. for: C₉H₁₀BrNO₃S: C, 37.00, H, 3.45, N, 4.79. Found: C, 36.26, H, 3.19, N, 4.67.

EXAMPLE 112N-{4-[(1R)-2-Bromo-1-hydroxyethyl]phenyl}methanesulfonamide

The title compound was prepared from N-[4-(2-bromoacetyl)phenyl]methanesulfonamide (0.23 g, 0.82 mmol) (which was obtained in Example 111), and 1M BH₃/THF solution (10.35 mL, 10.5 mmol) in substantially the same manner, as described in Example 103 and was obtained as a white solid (1.75 g, 72 % yield); MS (ES) m/z: 293 (M)⁺; ¹H NMR (400 MHz, DMSO-d₆) δ 7.14 (d, 2H), 2.95 (s, 3H), 3.53 (m, 1H), 3.55 (m, 1H), 4.73, (m, 1H), 5.75 (d, 1H), 7.14 (d, 2H), 9.74 (s, 1H).

EXAMPLE 113N-{4-[(1S)-2-bromo-1-hydroxyethyl]phenyl}methanesulfonamide

A mixture of N-{4-[(1S)-2-bromo-1-hydroxyethyl]phenyl}methanesulfonamide (which was obtained in Example 112) (1.73 g, 5.9 mmol), sodium iodide (0.88g, 5.9 mmol), sodium azide (1.53g, 23.6 mmol), and methyl sulfoxide (15 mL) was stirred at ambient temperature for 7 days, poured into water and extracted with ethyl acetate. The organic extracts were washed with water, and dried over MgSO₄. Evaporation and purification by flash chromatography (hexanes/chloroform/isopropylalcohol 5/4.5/0.5) gave an off-white solid (0.56 g, 70 % yield); MS (ES) m/z: 256 (M)⁺; ¹H NMR (400 MHz, DMSO-d₆) δ 2.94 (s, 3H), 3.30 (m, 2H), 4.74 (m, 1H), 5.75 (d, 1H), 7.17 (d, 2H), 7.32 (d, 2H), 9.67(s, 1H).

EXAMPLE 114N-{4-[(1R)-2-Amino-1-hydroxyethyl]phenyl}methanesulfonamide

A mixture of N-{4-[(1S)-azido-1-hydroxyethyl]phenyl}methanesulfonamide (which was obtained in Example 113) (0.55 g, 2.146 mmol), 10 % Pd/C (0.03 g) and methanol (30 mL) was hydrogenated on a Parr shaker at 50 psi for 3 hours. The catalyst was removed by filtration through celite. The filtrate was concentrated under vacuo to give an off-white solid (0.48 g, 97 % yield); MS (ES) m/z: 231 (MH⁺); ¹H NMR (400 MHz, DMSO-d₆) δ 2.57 (m, 2H), 2.94 (s, 3H), 3.4-4.2 (br, 2H), 4.38 (m, 1H), 4.6-5.8 (br, 2H), 7.23 (d, 2H), 7.26 (d, 2H).

EXAMPLE 115N-(4-{(1R)-2-[(1-{4-[(2,4-Dioxo-1,3-thiazolidin-5-yl)methyl]phenyl}piperidine-4-yl)amino]-1-hydroxyethyl})phenyl)methanesulfonamide

The title compound was prepared from N-{4-[(1R)-2-amino-1-hydroxyethyl]phenyl}methanesulfonamide (which was obtained in Example 114) and 5-[4-(4-oxopiperidine-1-yl)-benzyl]-1,3-thiazolidine-2,4-dione (which was obtained in Example 38) in substantially the

same manner, as described in Example 106 and was obtained as a white solid(0.33 g, 50 % yield); mp 138-145 °C; MS (ES) m/z: 519 (MH⁺); ¹H NMR (400 MHz, DMSO-d₆) δ 1.49 (m, 2H), 1.97 (m, 2H), 2.65 (t, 2H), 2.88-2.95 (br, 5H), 3.20-3.45 (br, 3H), 3.63 (d, 2H), 4.68 (m, 1H), 4.70 (m, 1H), 6.85 (d, 2H), 7.02 (d, 2H), 7.18 (d, 2H), 7.32 (d, 2H), 8.01-9.21 (br, 3H).

5

EXAMPLE 116Dibromoformaldoxime

A mixture of glyoxylic acid monohydrate (96.63 g, 1.05 mol), hydroxylamine hydrochloride (73.7 g, 1.06 mol) and water was stirred at ambient temperature for 18 hours. Sodium bicarbonate (176.4 g, 2.1 mol) was carefully added over 30 minutes followed by methylene chloride (600 mL). The new mixture was cooled to 5 °C and a solution of bromine (75 mL, 2.9 mol) in methylene chloride (350 mL) was added at such a rate that the temperature did not rise above 5 °C. Upon completion of the addition of bromine the mixture was further stirred at 5 °C and the organic layer was separated. The aqueous layer was extracted with methylene chloride. The combined organic extracts were dried over MgSO₄. Evaporation and purification by recrystallization from hexanes gave a white solid (32.5 g, 15 % yield); ¹H NMR (400 MHz, DMSO-d₆) δ 11.73 (s, 1H).

EXAMPLE 11720 3-Bromo-5-acetylisoxazole

A mixture of dibromoformaldoxime(which was obtained in Example 116) (32.5 g, 160.2 mmol), 3-butyne-1-one (13.41 g, 197 mmol), potassium carbonate (11g, 80.1 mmol), and methylene chloride (300 mL) was stirred at ambient temperature for 20 hours. The slurry was then treated with aqueous hydrochloric acid (2 N, 200 mL) and extracted with methylene chloride. The combined organic extracts were dried over MgSO₄. Evaporation and purification by flash chromatography (ethyl acetate/hexanes 5/95) gave a white solid (16.76 g, 56 % yield); ¹H NMR (300 MHz, CDCl₃) δ 2.62 (s, 3H), 6.97 (s, 1H).

EXAMPLE 11830 3-Bromo-5-(bromoacetyl)isoxazole

A mixture of 3-bromo-5-acetylisoxazole (which was obtained in Example 117) (16.7 g, 87.9 mmol), phenyltrimethylammonium tribromide(33.4g, 88.8 mmol) and tetrahydrofuran (150 mL) was stirred at ambient temperature for 18 hours, poured into water and extracted with ether. The organic extracts were washed with brine and dried over MgSO₄. Evaporation and

purification by distillation gave a light yellow oil (8.9 g, 40% yield); ^1H NMR (300 MHz, CDCl_3) δ 4.40. (s, 3H), 7.10 (s, 1H).

EXAMPLE 119

5 (1R)-2-Bromo-1-(3-bromoisoxazole-5-yl)ethanol

The title compound was prepared from 3-bromo-5-(bromoacetyl)isoxazole (which was obtained in Example 118), (R)-2-methyl-CBS-oxaborolidine monohydrate, and 1 M BH_3/THF solution in substantially the same manner, as described in Example 103 with one change; the crude product was purified by flash chromatography and reverse phase chromatography to
10 give a colorless oil (1.45 g, 16 % yield): ^1H NMR (300 MHz, CDCl_3) δ 3.67 - 3.81 (m, 2H), 5.16. (m, 1H), 6.49 (s, 1H).

EXAMPLE 120

3-Bromo-5-[(2S)-oxiran-2-yl]isoxazole

15 A mixture of (1R)-2-bromo-1-(3-bromoisoxazole-5-yl)ethanol (which was obtained in Example 119) (1.44g, 5.31 mmol), potassium carbonate (1.46 g, 10.62 mmol) and acetone (30 mL) was stirred at ambient temperature for 48 hours. The reaction mixture was filtered, and the solvent was removed in vacuo. The residue was purified by flash chromatography (hexanes/chloroform/isopropyl alcohol 8/1.8/0.2) to give a colorless oil (0.774 g, 53 % yield);
20 ^1H NMR (300 MHz, CDCl_3) δ 3.17 (m, 1H), 3.21 (m, 1H), 3.99 (m, 1H), 6.38 (s, 1H).

EXAMPLE 121

(1S)-2-Amino-1-(3-bromoisoxazole-5-yl)ethanol

The title compound was prepared from 3-bromo-5-[(2S)-oxiran-2-yl]isoxazole (which
25 was obtained in Example 120) in substantially the same manner as described in Example 105 and was obtained as an off-white solid (0.54 g, 90 % yield): MS (ES) m/z : 207 (MH) $^+$; ^1H NMR (400 MHz, CDCl_3) δ 1.7 (br, 3H), 3.13 (br, 2H), 4.77 (t, 1H), 6.35 (s, 1H).

EXAMPLE 122

30 5-[4-(4-[(4-(2S)-2-(3-Bromoisoxazol-5-yl)-2-hydroxyethyl]amino)piperidine-1-yl)benzyl]-1,3-thiazolidine-2,4-dione

The title compound was prepared from (1S)-2-amino-1-(3-bromoisoxazole-5-yl)ethanol (which was obtained in Example 121) and 5-[4-(4-oxopiperidine-1-yl)benzyl]-1,3-thiazolidine-2,4-dione (which was obtained in Example 38) in substantially the same manner, as described

in Example 106 and was obtained as a white solid (0.13 g, 88 % yield); mp 145-150 °C; MS (ES) m/z: 519 (MH⁺); ¹H NMR (400 MHz, DMSO-d₆) δ 1.49 (m, 2H), 1.97 (m, 2H), 2.65 (t, 2H), 2.88-2.95 (br, 5H), 3.20-3.45 (br, 3H), 3.63 (d, 2H), 4.68 (m, 1H), 4.70 (m, 1H), 6.85 (d, 2H), 7.02 (d, 2H), 7.18 (d, 2H), 7.32 (d, 2H), 8.00-9.20 (br, 3H).

5

EXAMPLE 1233-(2-Oxiranylmethoxy)pyridine

Sodium hydride (60%, 2.16 g, 54.0 mmol) was added portionwise into N,N-dimethylformamide (50 mL) with stirring at room temperature under a nitrogen atmosphere. A solution of 3-pyridinol (4.5 g, 46.28 mmol) in N,N-dimethylformamide (50 mL) was then added dropwise to this suspension over a period of 0.5 hour. After stirring for 1 hour a solution of (2S)-oxiranylmethyl 3-nitrobenzenesulfonate (10 g, 38.57 mmol) in N,N-dimethylformamide (50 mL) was added dropwise into this mixture over a period of 15 minutes. The mixture was then stirred at room temperature overnight. The reaction was quenched with aqueous ammonium chloride to pH 5 and extracted with ethyl acetate. The extracts were washed with water and dried with brine. Evaporation and purification by flash column chromatography (dichloromethane/methyl alcohol 95/5) gave a brown oil (1.44 g, 25% yield); ¹H NMR (400 MHz, DMSO-d₆) δ 2.71-2.73 (m, 1 H), 2.81-2.84 (m, 1 H), 3.34-3.38 (m, 1 H), 3.87-3.92 (m, 1 H), 4.40-4.43 (m, 1 H), 7.30-7.33 (m, 1 H), 7.39-7.41 (m, 1 H), 8.17-8.19 (m, 1 H), 8.31 (s, 1 H); MS (ES) m/z: 152 (MH⁺).

20

EXAMPLE 124(2S)-1-Amino-3-(3-pyridinyloxy)-2-propanol

A solution of 3-(2-oxiranylmethoxy)pyridine (which was obtained in Example 123) (1.41 g) in 120 mL of saturated ammonium methanol was stirred at 0 °C for two days. The reaction mixture was concentrated to give a yellow semi-solid (1.56 g, 99.5% yield); ¹H NMR (400 MHz, DMSO-d₆) δ 1.60 (brs, 2 H), 2.55-2.59 (m, 1 H), 2.61-2.68 (m, 1 H), 3.67-3.72 (m, 1 H), 3.89-3.93 (m, 1 H), 4.00-4.04 (m, 1 H), 4.90 (brs, 1 H), 7.29-7.32 (m, 1 H), 7.36-7.38 (m, 1 H), 8.13-8.14 (d, 1 H), 8.27 (s, 1 H); MS (ES) m/z: 138 (M⁺); Anal. Calcd. for C₇H₁₀N₂O: C, 57.13; H, 7.19; N, 16.66. Found: C, 57.83; H, 7.17; N, 18.98.

30

EXAMPLE 125**5-(4-{4-[(2S)-2-Hydroxy-3-(pyridin-3-yloxy)-propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione**

(2S)-1-Amino-3-(3-pyridinyloxy)-2-propanol (0.21 g, 1.25 mmol) (which was obtained in Example 124) and 5-[4-(4-oxo-1-piperidiny)benzyl]-1,3-thiazolidine-2,4-dione (which was obtained in Example 38) (0.413, 1.25 mmol) were mixed in N,N-dimethylformamide (12 mL) and then treated with sodium triacetoxyborohydride (0.56 g, 2.5 mmol) and acetic acid (0.26 mL). After stirring at room temperature under a nitrogen atmosphere for one day, the mixture was purified by column chromatography (dichloromethane/methyl alcohol 85/5) to give the title compound as a yellow solid (0.25 g, 56% yield); mp: 130-132 °C; ¹H NMR (400 MHz, DMSO-d₆) δ 1.20-1.54 (m, 2 H), 1.90-2.02 (m, 2 H), 2.67 (t, 2 H), 2.78-2.97 (m, 4 H), 3.22-3.26 (m, 1 H), 3.35 (brs, 2 H), 3.64-3.70 (d, 2 H), 3.97-4.08 (m, 3 H), 4.60-4.63 (m, 1 H), 6.84-6.86 (m, 2 H), 7.03-7.05 (m, 2 H), 7.30-7.36 (m, 1 H), 7.38-7.40 (m, 1 H), 8.16-8.17 (m, 1 H), 8.8.29-8.30 (m, 1 H); MS (ES) m/z: 457 (MH⁺).

EXAMPLE 126**2-Methyl-5-(2-oxiranylmethoxy)pyridine**

The title compound was prepared from 6-methyl-3-pyridinol and (2S)-oxiranylmethyl 3-nitrobenzenesulfonate in substantially the same manner as described in Example 123. The product was obtained as a brown oil; ¹H NMR (400 MHz, DMSO-d₆) δ 2.38 (s, 2.38, 1H), 2.68-2.70 (m, 1 H), 2.81-2.84 (m, 1 H), 3.30-3.34 (m, 1 H), 3.83-3.87 (m, 1 H), 4.34-4.38 (m, 1 H), 7.15-7.17 (m, 1 H), 7.28-7.31 (m, 1 H), 8.15-8.16m (m, 1 H); MS (ES) m/z: 165 (M)⁺.

EXAMPLE 127**(2S)-1-Amino-3-[(6-methyl-3-pyridinyl)oxy]-2-propanol**

The title compound was prepared from 2-methyl-5-(2-oxiranyl-methoxy)pyridine (which was obtained in Example 126) in substantially the same manner as described in Example 124. The product was obtained as an oil; ¹H NMR (400 MHz, DMSO-d₆) δ 1.65 (brs, 2 H), 2.37 (s, 1 H), 2.53-2.58 (m, 1 H), 2.63-2.69 (m, 1 H), 4.60 (brs, 1 H), 3.84-3.88 (m, 1 H), 3.95-3.99 (m, 1 H), 7.13-7.15 (m, 1 H), 7.25-7.28 (m, 1 H), 8.12-8.13 (m, 1 H), 8.13-8.14 (d, 1 H); MS (ES) m/z: 183 (MH⁺).

EXAMPLE 1285-(4-{4-[(2S)-2-Hydroxy-3-(6-methyl-pyridin-3-yloxy)-propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione

The title compound was prepared from (2S)-1-amino-3-[(6-methyl-3-pyridinyl)oxy]-2-propanol (which was obtained in Example 127) and 5-[4-(4-oxo-1-piperidinyl)benzyl]-1,3-thiazolidine-2,4-dione (which was obtained in Example 38) in substantially the same manner, as described in Example 125. The product was obtained as a yellow solid; mp 87 °C (decomposed); ¹H NMR (400 MHz, DMSO-d₆) δ 1.44-1.49 (m, 2 H), 1.93-1.97 (m, 2 H), 2.38 (s, 3 H), 2.64-2.70 (m, 2 H), 2.77-2.95 (m, 4 H), 3.23-3.27 (m, 1H), 3.35 (brs, 2 H), 3.64-3.67 (m, 2H), 3.93-4.02 (m, 3 H), 4.58-4.62 (m, 1 H), 6.84-6.86 (m, 2 H), 7.03-7.05 (m, 2 H), 7.15-7.17 (m, 1 H), 7.27-7.30 (m, 1 H), 8.14-8.15 (m, 1 H); MS (ES) m/z: 469 (M-H)⁻.

EXAMPLE 1293-[(2S)-Oxiranyl]pyridine

A solution of borane-THF (1.0 M solution, 22.8 mL) was added dropwise into a cold (0°C) solution of (S)-2-methyl-CBS-oxazaborolidine monohydrate (1.12 g, 3.8 mmol) in tetrahydrofuran (20 mL), over a period of 10 minutes. After stirring at 0 °C for 10 minutes, the mixture was added dropwise to a cold (0°C) suspension of 3-(2-bromoacetyl)pyridine hydrobromide (10.6 g, 38.0 mmol) in tetrahydrofuran (70 mL) over a period of 10 minutes. After the addition the mixture was stirred at room temperature, under a nitrogen atmosphere, overnight. The reaction was cooled to 0 °C and quenched with hydrogen chloride (0.5 M in methanol, 9 mL). The mixture was further diluted with water and extracted with ethyl acetate. The extracts were washed with water and dried with MgSO₄. Evaporation and purification by flash column chromatography (dichloromethane/methyl alcohol 95/5) gave (1R)-2-bromo-1-(3-pyridinyl)-1-ethanol as a brown oil (2.01 g, 27% yield). This oil was dissolved in tetrahydrofuran (18 mL) and then sodium hydroxide (5N, 35 mL) was added. The solution was stirred at room temperature for 10 minutes. The mixture was diluted with water and extracted with dichloromethane. The extracts were washed with water, dried with magnesium sulfate. The extracts were concentrated to give the title compound as a white solid (1.01 g, 84% yield); ¹H NMR (300 MHz, DMSO-d₆) δ 2.93-2.97 (m, 2 H), 3.14-3.17 (m, 2 H), 3.99-4.01 (m, 2 H), 7.36-7.40 (m, 1 H), 7.63-7.66 (m, 1 H), 8.51-8.55 (m, 3 H); MS (ES) m/z: 122 (MH⁺).

EXAMPLE 130(1S)-2-Amino-1-(3-pyridinyl)-1-ethanol

The title compound was prepared from 3-[(2S)-oxiranyl]pyridine (which was obtained in Example 129) and saturated ammonium methanol in substantially the same manner, as described in Example 124. The product was obtained as a brown oil; ¹H NMR (400 MHz, DMSO-d₆) δ 1.60 (brs, 2 H), 2.59-2.71 (m, 2 H), 4.47-4.50 (m, 1 H), 5.20 (brs, 1 H), 7.31-7.34 (m, 1 H), 7.68-7.71 (m, 1 H), 8.42-8.43 (m, 1 H), 8.50-8.51 (m, 1 H); MS (ES) m/z: 139 (MH⁺).

EXAMPLE 1315-{4-[4-((2S)-2-Hydroxy-2-pyridin-3-yl-ethylamino)-piperidin-1-yl]-benzyl}-thiazolidine-2,4-dione

The title compound was prepared from (1S)-2-amino-1-(3-pyridinyl)-1-ethanol (which was obtained in Example 130) and 5-[4-(4-oxo-1-piperidinyl)benzyl]-1,3-thiazolidine-2,4-dione (which was obtained in Example 38) in substantially the same manner, as described in Example 125. The product was obtained as a yellow solid; mp: >88 °C decomposed; ¹H NMR (400 MHz, DMSO-d₆) δ 1.38-1.50 (m, 2 H), 1.90-1.98 (m, 2 H), 2.63-2.71 (t, 2 H), 2.78-2.96 (m, 4 H), 3.23-3.27 (m, 1 H), 3.62-3.65 (m, 2 H), 4.62-4.67 (m, 1 H), 4.76-4.79 (m, 1 H), 6.83-6.86 (d, 2 H), 7.03-7.05 (d, 2 H), 7.36-7.38 (m, 1 H), 7.76-7.79 (m, 1 H), 8.46-8.48 (m, 1 H), 8.57-8.58 (m, 1 H); MS (ES) m/z: 427 (MH⁺); Anal. Calcd. for C₂₂H₃₆N₄O₂ · x 0.3 H₂O · x 0.3 CH₂Cl₂: C, 55.87; H, 5.51; N, 11.69. Found: C, 55.92; H, 5.80; N, 11.45.

EXAMPLE 132(1R)-2-Amino-1-[1,2,3,4]tetraazolo[1,5-a]pyridin-6-yl-1-ethanol

The title compound was prepared from 6-[(2R)oxiranyl][1,2,3,4]tetraazolo[1,5-a]pyridine and saturated ammonium methanol in substantially the same manner, as described in Example 124. The product was obtained as an off-white solid; mp 153-154 °C; ¹H NMR (400 MHz, DMSO-d₆) δ 1.60 (brs, 2 H), 2.73-2.84 (m, 2 H), 4.65-4.68 (m, 1 H), 5.70 (brs, 1 H), 7.83-7.87 (m, 1 H), 8.14-8.16 (m, 1 H), 9.08-9.09 (m, 1 H); MS (ES) m/z: 180 (M+H).

EXAMPLE 1335-(4-{4-[[(2S)-2-(6-Amino-pyridin-3-yl)-2-hydroxy-ethylamino]-piperidin-1-yl]-benzyl}-thiazolidine-2,4-dione hydrochloride

5-[4-(4-{[(2R)-2-Hydroxy-2-[1,2,3,4]tetraazolo[1,5-a]pyridin-6-ylethyl]amino}-1-piperidin-yl)benzyl]-1,3-thiazolidine-2,4-dione was prepared from (1R)-2-amino-1-[1,2,3,4]tetraazolo[1,5-a]pyridin-6-yl-1-ethanol (which was obtained in Example 132) and 5-[4-(4-oxo-1-piperidinyl)-

benzyl]-1,3-thiazolidine-2,4-dione(which was obtained in Example 38) in substantially the same manner, as described in Example 125. The product was obtained as a yellow solid; mp: 130-132°C. This solid was dissolved in concentrated aqueous hydrochloric acid (0.3 mL) and methyl alcohol (2 mL). Tin chloride (0.196 g, 0.87 mmol) was added to the solution at room temperature. The mixture was then stirred at reflux for 2 hours. Evaporation and purification by flash column chromatography (dichloromethane/methyl alcohol 7/3)] gave a yellow solid. This solid was further purified by reverse phase HPLC to give a yellow solid (0.117 g, 61% yield); mp 182 °C (decomposed); ¹H NMR (400 MHz, DMSO-d₆) δ 1.90 (brs, 2 H), 2.21 (brs, 2 H), 3.03-3.36 (m, 8 H), 3.75-3.79 (m, 1 H), 4.86-4.90 (m, 1 H), 4.98-5.01 (m, 1 H), 7.03-7.05 (m, 1H), 1.20 (brs, 4 H), 7.95-7.99 (m, 2 H), 8.21 (brs, 1 H), 9.13 (brs, 1 H), 9.45 (brs, 1 H), 12.04 (brs, 1 H), 14.13 (brs, 1 H); MS (ES) m/z: 442 (MH⁺).

EXAMPLE 134

3-[(2R)-Oxiranyl]pyridine

The title compound was prepared from (R)-2-methyl-CBS-oxazaborolidine monohydrate and 3-(2-bromoacetyl)pyridine hydrobromide in substantially the same manner, as described in Example 123. The product was obtained as an oil; ¹H NMR (300 MHz, DMSO-d₆) δ 2.94-2.97 (m, 1 H), 3.14-3.17 (m, 1 H), 3.99-4.01 (m, 1 H), 7.36-7.40 (m, 1 H), 7.63-7.66 (m, 1 H), 8.51-8.55 (m, 2 H); MS (ES) m/z: 121 (M⁺).

EXAMPLE 135

(1R)-2-Amino-1-(3-pyridinyl)-1-ethanol

The title compound was prepared from 3-[(2R)-oxiranyl]pyridine (which was obtained in Example 134) and saturated ammonium methanol in substantially the same manner, as described in Example 124. The product was obtained as a brown oil; ¹H NMR (300 MHz, DMSO-d₆) δ 1.70 (brs, 2 H), 2.62-2.74 (m, 2 H), 4.46-4.50 (m, 1 H), 5.20 (brs, 1 H), 7.30-7.34 (m, 1 H), 7.68-7.71 (m, 1 H), 8.42-8.50 (m, 2 H); MS (ES) m/z: 139 (MH⁺).

EXAMPLE 136

5-{4-[4-((2R)-2-Hydroxy-2-pyridin-3-yl-ethylamino)-piperidin-1-yl]-benzyl}-thiazolidine-2,4-dione

The title compound was prepared from (1R)-2-amino-1-(3-pyridinyl)-1-ethanol (which was obtained in Example 135) and 5-[4-(4-oxo-1-piperidinyl)benzyl]-1,3-thiazolidine-2,4-dione(which was obtained in Example 38) in substantially the same manner, as described in Example 125. The product was obtained as a yellow solid; mp 87 °C (decomposed); ¹H NMR

(400 MHz, DMSO- d_6) δ 1.38-1.43 (m, 2 H), 1.89-1.91 (m, 2 H), 2.62-2.71 (t, 2 H), 2.71-2.91 (m, 4 H), 3.23-3.27 (m, 1 H), 3.60-3.63 (m, 2 H), 4.58-4.61 (m, 1 H), 4.72-4.75 (m, 1 H), 6.83-6.85 (d, 2 H), 7.02-7.05 (d, 2 H), 7.34-7.37 (m, 1 H), 7.75-7.78 (m, 1 H), 8.45-8.46 (m, 1 H), 8.56-8.57 (m, 1 H); MS (ES) m/z : 427 (MH^+).

5

EXAMPLE 137*N*-[5-(2-Bromoacetyl)-2-pyridinyl]methanesulfonamide

A solution of methane sulfonyl chloride (7.5 mL, 96.80 mmol) in dichloromethane (50 mL) was added dropwise into a cold (-78 °C) solution of 1-(6-amino-3-pyridinyl)-1-ethanone (3.29 g, 24.20 mmol) and *N,N*-diisopropylethylamine (4.20 mL, 96.80 mmol) in dichloromethane/ acetonitrile (1/1, 250 mL) over a period of 30 minutes. After the addition the dry-ice bath was removed and reaction mixture was warmed gradually to room temperature. After stirring at room temperature for 2 days, the mixture was evaporated and purified by flash column chromatography (hexanes/ethyl acetate 3/7) to give a grey solid (1.0 g, 19 % yield). This solid (0.9 g, 4.2 mmol) was added portionwise to a room temperature stirred solution of 5,5-dibromobarbituric acid (2.17 g, 7.35 mmol) in tetrahydrofuran (18 mL). After stirred at 60 °C for 6 hours the mixture was evaporated and purified by flash column chromatography (hexanes/ethyl acetate 1/ 1) to give an off-white solid (1.03 g, 84 % yield); 1H NMR (400 MHz, DMSO- d_6) δ 3.33 (s, 3 H), 4.87 (s, 2 H), 7.04-7.07 (m, 1 H), 8.20-8.23 (m, 1 H), 8.87 (s, 1 H); MS (ES) m/z : 292 (M^+); Anal. Calcd. for $C_8H_9BrN_2O_3S$: C, 32.78; H, 3.09; N, 9.56. Found: C, 33.27; H, 2.92; N, 9.60.

EXAMPLE 138*N*-[5-(2-{1-[4-(2,4-Dioxo-thiazolidin-5-yl)methyl]-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-pyridin-2-yl]-methanesulfonamide

Sodium borohydride (0.09 g, 2.34 mmol) was added portionwise into a cold (0 °C) solution of *N*-[5-(2-bromoacetyl)-2-pyridinyl]methanesulfonamide (which was obtained in Example 137)(0.91 g, 3.12 mmol) in THF (15 mL). After the mixture was stirred at 0 °C for 1.5 hours, the mixture was evaporated and purified by flash column chromatography (dichloromethane 95/5) to give an off-white solid (0.66 g, 72 %). A mixture of this solid (0.44 g, 1.54 mmol), sodium iodide (0.23 g, 1.54 mmol) and sodium azide (0.41 g, 6.16 mmol) in dimethyl sulfoxide (4 mL) was stirred at room temperature for 3 days. The mixture was purified by flash column chromatography (hexanes/ethyl acetate 1/3) to give an oil. This oil was dissolved in methyl alcohol (25 mL) and 10 % Pd-C. The mixture was hydrogenated to give *N*-[5-(2-amino-1-hydroxyethyl)-2-pyridinyl]methanesulfonamide as an oil. This oil was treated with

5-[4-(4-oxo-1-piperidiny)benzyl]-1,3-thiazolidine-2,4-dione(which was obtained in Example 38) in substantially the same manner, as described in Example 125, to give the title compound as a white solid; mp 57-59 °C; ¹H NMR (400 MHz, DMSO-d₆) δ 1.20-1.31 (m, 2 H), 1.55-1.64 (m, 2 H), 2.01-2.08 (m, 2 H), 3.60-3.71 (t, 2 H), 3.93-3.42 (m, 6 H), 3.71-3.75 (m, 2 H), 4.77-4.87 (m, 2 H), 6.86-6.88 (d, 2 H), 6.98-7.00 (m, 1 H), 7.05-7.07 (d, 2 H), 7.75-7.77 (m, 1 H), 8.22-8.23 (m, 1 H); MS (ES) m/z: 520 (MH⁺); Anal. Calcd. for C₂₃H₂₉N₅O₅S₂ x 3 CF₃COOH: C, 40.42; H, 3.74; N, 8.13. Found: C, 40.15; H, 4.06; N, 8.10.

EXAMPLE 139

10 2-Methyl-5-oxiranylmethoxy-1H-indole-3-carboxylic acid ethyl ester

A solution of 2.19 g (10 mmol) of ethyl 5-hydroxy-2-methyl-indole-3-carboxylate, 2.6 g (10 mmol) of 2S(+) glycidyl-3-nitrobenzenesulfonate and 1.5 g (11 mmol) of potassium carbonate in 25 mL reagent grade acetone was refluxed overnight. The mixture was then allowed to cool to room temperature and the solids were removed by vacuum filtration. The filtrate was concentrated in vacuo and the residue was dissolved in ethyl acetate. The organics were washed once with water, twice with brine, dried over sodium sulfate and concentrated in vacuo. Then the solid was dried under vacuum to give 2.65 g of the title compound as a dull tan solid; mp 93-94 °C; ¹H NMR (300 MHz, CDCl₃) δ 1.44 (t, J = 5.3 Hz, 3H), 2.71 (s, 3H), 2.74-2.80 (m, 1H), 2.92 (t, J = 4.7 Hz, 1H), 3.37-3.43 (m, 1H), 4.00-4.06 (m, 1 H), 4.27-4.31 (m, 1H), 4.37 (q, J = 5.3 Hz, 2H), 6.86 (dd, J = 5.5, 3.0 Hz, 1H), 7.18 (d, J = 8.7 Hz, 1H), 7.67 (d, J = 3.0 Hz, 1H), 8.32 (s, 1H); MS (ES) m/z: 275.9 (MH⁺); HRMS Calcd. for C₁₅H₁₈NO₄(MH⁺): 276.1236. Found: 276.1228.

EXAMPLE 140

25 5-((2S)-3-Azido-2-hydroxy-propoxy)-2-methyl-1H-indole-3-carboxylic acid ethyl ester

A solution of 1.4 g (5.1 mmol) of 2-methyl-5-oxiranylmethoxy-1H-indole-3-carboxylic acid ethyl ester (which was obtained in Example 139), 0.5 g (7.6 mmol) of sodium azide and 0.43 g (10.2 mmol) of lithium chloride in 15 mL anhydrous DMF was heated at 60 °C overnight. The mixture was cooled to room temperature and quenched with water. The aqueous mixture was extracted with ethyl acetate. The organic layer was washed twice with water, dried over sodium sulfate and concentrated in vacuo. The residue was then purified by flash chromatography (10% EtOAc in hexanes to 50% EtOAc in hexanes) to give 0.63 g of the title compound as a yellow solid; mp 75-77 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 1.34 (t, J = 7.1 Hz, 3H), 2.66 (s, 3H), 3.42 (d, 4.6 Hz, 1H), 3.89-3.95 (m, 2H), 4.00-4.06 (m, 1H), 4.26 (q, J = 7.1

Hz, 2H), 5.55 (d, J = 5.1 Hz, 2H), 6.76 (dd, J = 8.7, 2.7 Hz, 1H), 7.24 (d, J = 8.7 Hz, 1H), 7.43 (d, J = 2.4 Hz, 1H), 11.65 (s, 1H); MS (ES) m/z: 319.0 (MH⁺); HRMS Calcd. for C₁₅H₁₈N₄O₄(M⁺): 318.1328. Found: 318.1334.

5 EXAMPLE 141

5-((2S)-3-Amino-2-hydroxy-propoxy)-2-methyl-1H-indole-3-carboxylic acid ethyl ester

A solution of 0.56 g (1.76 mmol) of 5-((2S)-3-azido-2-hydroxy-propoxy)-2-methyl-1H-indole-3-carboxylic acid ethyl ester (which was obtained in Example 140) and 1.2 g of triphenylphosphine polymer resin (3mmol/g) was stirred in 15 mL toluene for 1.5 hours under nitrogen. The resin was collected by filtration and washed twice with 25 mL of toluene. The resin was then stirred in 60 mL of 9:1 THF/methanol for four hours. The resin was removed by vacuum filtration and washed with 9:1 THF/methanol. The filtrate was concentrated in vacuo. Then the solid was dried under vacuum to give 0.52 g of the title compound as a beige solid; mp 66-68 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 1.32-1.37 (m, 3H), 1.80 (brs, 1H), 2.61 (s, 3H), 2.69-2.75 (m, 2H), 3.69-3.76 (m, 1H), 3.82-3.95 (m, 2H), 4.23 (q, J = 6.93 Hz, 2H), 4.90 (brs, 1H), 6.76 (dd, J = 2.52 Hz, 8.73 Hz, 1H), 7.23 (d, J = 8.7 Hz, 1H), 7.43 (d, J = 2.4 Hz, 1H), 8.85 (brs, 1H), 11.65 (s, 1H); MS (ES) m/z: 293.0 (MH⁺); HRMS Calcd. for C₁₅H₂₁N₂O₄(MH⁺): 293.1501. Found: 293.1498.

20 EXAMPLE 142

5-(3-{1-[4-(2,4-Dioxo-thiazolidin-5-ylmethyl)-2-fluoro-phenyl]-piperidin-4-ylamino}-(2S)-2-hydroxy-propoxy)-2-methyl-1H-indole-3-carboxylic acid ethyl ester

The title compound was prepared from 5-((2S)-3-amino-2-hydroxy-propoxy)-2-methyl-1H-indole-3-carboxylic acid ethyl ester (which was obtained in Example 141) and 5-[3-fluoro-4-(4-oxo-piperidin-1-yl)-benzyl]-thiazolidine-2,4-dione (which was obtained in Example 61) according to the procedure of Example 73 as a yellow solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.34 (t, J = 7.1 Hz, 3H), 1.56-1.63 (m, 2H), 2.03 (m, 2H), 2.61 (s, 3H), 2.67-2.75 (m, 4H), 2.88-2.96 (m, 4H), 3.04-3.07 (m, 2H), 3.95-3.97 (m, 2H), 4.05 (m, 2H), 4.25 (q, J = 7.1 Hz, 2H), 4.61-4.66 (m, 1H), 5.52 (brs, 1H), 6.79 (dd, J = 8.7, 2.5 Hz, 1H), 6.94-7.03 (m, 2H), 7.24-7.29 (m, 2H), 7.46 (d, J = 2.3 Hz, 1H) 11.65 (s, 1H); MS (ES) m/z: 599.1 (MH⁺); HRMS for C₃₀H₃₆FN₄O₆S(MH⁺): 599.2339. Found: 599.2333.

EXAMPLE 143**1-(1,4-Dioxa-8-aza-spiro[4.5]dec-8-yl)-3-[4-(1,4-dioxa-8-aza-spiro[4.5]dec-8-yl)-phenyl]-propane-1,3-dione**

A mixture of methyl 4-fluorobenzoyl acetate (2.06 g, 10 mmol), 1,4-dioxa-8-aza-spiro[4.5]decane (2.19 g, 15 mmol), and potassium carbonate (1.66 g, 12 mmol) in 3 mL of 1,3-dimethyl-3,4,5,6-tetrahydro-2(1H)-pyrimidinone was stirred at 60° C for 3 days. It was then diluted with water and the gummy precipitate was washed with water, ether, and ethyl acetate-ether (1:5), and then dried in vacuo to give 0.98 g of yellow solid; ¹H NMR (300 MHz, CDCl₃) δ 1.66-1.72 (dd, 4 H), 1.77-1.81 (d, 4 H), 3.51-3.55 (m, 4 H), 3.57-3.61 (m, 2 H), 3.70-3.741 (m, 2 H), 3.96 (s, 4 H), 4.00 (s, 4 H), 4.03 (s, 2 H), 6.68 (d, 2 H), 7.94 (d, 2 H); MS (ES) m/z: 431 (MH⁺).

EXAMPLE 144**5-[4-(1,4-Dioxa-8-aza-spiro[4.5]dec-8-yl)-phenyl]-1,2-dihydro-pyrazol-3-one**

1-(1,4-Dioxa-8-aza-spiro[4.5]dec-8-yl)-3-[4-(1,4-dioxa-8-aza-spiro[4.5]dec-8-yl)-phenyl]-propane-1,3-dione (which was obtained in Example 143) (0.43 g, 1 mmol) was dissolved in a mixture of ethanol (10 mL) and tetrahydrofuran (4 mL). The solution was treated with 0.08 mL (2.4 mmol) of hydrazine and heated at reflux for 4 days. After cooling to room temperature, the resulting suspension was filtered, and the precipitate was washed with ethanol and dried in vacuo to give 0.24 g of light yellow solid; ¹H NMR (DMSO-d₆) δ 1.67-1.71 (t, 4 H), 3.29-3.32 (t, 4 H), 3.91 (s, 4 H), 5.72 (s, 1 H), 6.97 (d, 2 H), 7.48 (d, 2 H), 9.50 (brs, 1 H), 11.80 (brs, 1 H); MS (ES) m/z: 302 (MH⁺).

EXAMPLE 145**1-[4-(5-Oxo-2,5-dihydro-1H-pyrazol-3-yl)-phenyl]-piperidin-4-one**

To a suspension of 5-[4-(1,4-dioxa-8-aza-spiro[4.5]dec-8-yl)-phenyl]-1,2-dihydro-pyrazol-3-one (which was obtained in Example 144) (0.15 g, 0.5 mmol) in acetone (5 mL) was added 5 mL of 10% sulfuric acid. The resulting solution was stirred at room temperature for 4 days. Water (5mL) was then added, and the acetone was evaporated. The aqueous residue was treated with sodium carbonate until pH 8, and the resulting suspension was filtered. The precipitate was washed with water and ether, and dried in vacuo to give 0.15 g of tan solid; ¹H NMR (DMSO-d₆) δ 2.41 (t, 4 H), 3.64 (t, 4 H), 5.74 (s, 1 H), 7.04 (d, 2 H), 7.53 (d, 2 H), 9.55 (brs, 1 H), 11.80 (brs, 1 H); MS (ES) m/z: 258 (MH⁺).

EXAMPLE 146

N-[(2R)-2-Hydroxy-5-(1-hydroxy-2-[1-[4-(5-oxo-2,5-dihydro-1H-pyrazol-3-yl)-phenyl]-piperidin-4-ylamino]-ethyl)-phenyl]-methanesulfonamide

The title compound was prepared from 1-[4-(5-oxo-2,5-dihydro-1H-pyrazol-3-yl)-phenyl]-piperidin-4-one (which was obtained in Example 145)(0.13 g, 0.5 mmol) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (0.15 g, 0.6 mmol) (which was obtained in Example 10) according to the procedure shown for Example 73 to give 0.14 g of orange solid; mp 225-227 °C; ¹H NMR (DMSO-d₆) δ 1.15-1.20 (m, 2 H), 1.87-1.99 (m, 2 H), 2.64-2.75 (m, 5 H), 2.92 (s, 3 H), 3.66 (m, 2 H), 4.49 (m, 2 H), 5.71 (s, 1 H), 6.82 (d, 2H), 6.93 (d, 2 H), 7.02 (dd, 2 H), 7.19 (d, 2 H), 7.47 (d, 2 H); MS (ES) m/z: 488 (MH⁺).

EXAMPLE 147

4-(4-Oxo-1-piperidin-1-yl)benzamide

A suspension of 4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)benzonitrile (Taylor, E. C., Skotnicki, J. S. *Synthesis*, **1981**, 606)(15 g, 61.5 mmol) in 150 mL of concentrated hydrochloric acid was stirred at room temperature overnight. The solution was neutralized with 5N sodium hydrochloride and the solid that formed was collected to give the title compound as a white solid; ¹H NMR (300 MHz, CDCl₃) δ 2.58 (t, J = 6.1 Hz, 4 H), 3.74 (t, J = 6.1 Hz, 4 H), 5.76 (brs, 2 H), 6.94 (d, J = 9.0 Hz, 2 H), 7.74 (d, J = 9.0 Hz, 2 H); MS (ES) m/z: 218.8 (MH⁺); HRMS Calcd. for C₁₂H₁₄N₂O₂: 218.1055. Found: 218.1051

EXAMPLE 148

[4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-phenyl]-methanol

Sodium borohydride (3.78 g, 100 mmol) was added in four portions to a stirred solution of 4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzaldehyde (4.94g, 20 mmol) (Taylor, E. C., Skotnicki, J. S. *Synthesis*, **1981**, 606) in methanol /tetrahydrofuran (1:1, 100 mL) at 0 °C and the resulting solution was stirred at 0 °C for 30 minutes and then at room temperature for 1 hour. Methylene chloride was added and the solution was washed with water and dried over sodium sulfate. The solvents were removed and the residue was solidified upon standing (5.0g, 100%); ¹H NMR (300 MHz, CDCl₃) δ 1.84 (t, J = 5.7 Hz, 4 H), 3.33 (t, J = 5.7 Hz, 4 H), 3.99(s, 4 H), 4.59 (d, J = 5.8 Hz, 2 H), 6.93 (d, J = 8.7 Hz, 2 H), 7.24 (d, J = 8.7 Hz, 2 H); MS (ES) m/z: 249.9 (MH⁺); HRMS Calcd. for C₁₄H₂₀NO₃(MH⁺): 250.1443. Found: 250.1434.

EXAMPLE 1491-[4-(4-Oxo-piperidin-1-yl)-phenyl]-acetic acid

1-[4-(1,4-Dioxa-8-aza-spiro[4.5]dec-8-yl)-phenyl]-ethanone (2.61 g, 10 mmol) (Taylor, E. C., Skotnicki, J. S. *Synthesis*, **1981**, 606) was added to a solution of thallium trinitrate trihydrate (4.44g, 10 mmol) (McKillop, A., Swann, B. P., Taylor, E. C. *J. Am. Chem. Soc.*, **1971**, 93, 4919) in methanol (40 mL) and methylene chloride (20 mL) containing perchloric acid (70%, 10 mL). After 5 hours at room temperature the precipitated thallium (I) nitrate was removed by filtration, and the filtrate was diluted with water (100 mL). The organic phase was separated, the aqueous layer was extracted with methylene chloride, and the combined organic phases were washed with water, dried over sodium sulfate and concentrated. The residue was dissolved in concentrated hydrochloric acid (250 mL) at room temperature. After 3 hours the solution pH was adjusted to 5 by ~28% ammonium hydroxide. The aqueous layer was extracted with methylene chloride, and the combined organic phases were washed with water, dried over sodium sulfate and concentrated. The product was purified by chromatography on silica gel with ethyl acetate/hexanes eluant to give the title compound as a pale yellowish solid (0.4 g, 17%); ¹H NMR (300 MHz, DMSO-d₆) δ 2.42 (t, J = 6.0 Hz, 4 H), 3.41 (s, 2 H), 3.56 (t, J = 6.0 Hz, 4 H), 6.98 (d, J = 8.7 Hz, 2 H), 7.12 (d, J = 8.7 Hz, 2 H), 12.20 (s, 1 H); MS (ES) m/z: 234.3 (MH⁺); HRMS Calcd. for C₁₃H₁₅NO₃(M⁺): 233.1052. Found: 233.1045.

EXAMPLE 1504-(1,4-Dioxa-8-aza-spiro[4.5]dec-8-yl)-benzoic acid

A mixture of 4-(1,4-dioxa-8-aza-spiro[4.5]dec-8-yl)-benzoic acid ethyl ester (14 g, 48.1 mmol) (Taylor, E. C., Skotnicki, J. S. *Synthesis*, **1981**, 606) in methanol/tetrahydrofuran (1:1, 100 mL) and sodium hydroxide (2 N, 150 mL) was refluxed for 2 hours. After cooling to room temperature the solution was acidified by acetic acid and the solid which was formed was collected and dried to give the title compound as a white solid (12.5 g, 99%); ¹H NMR (300 MHz, CDCl₃) δ 1.67 (t, J = 5.6 Hz, 4 H), 3.43 (t, J = 5.6 Hz, 4 H), 3.92 (s, 4 H), 6.96 (d, J = 9.0 Hz, 2 H), 7.75 (d, J = 9.0 Hz, 2 H); MS (ES) m/z: 264.4 (MH⁺); HRMS Calcd. for C₁₄H₁₇NO₄(M⁺): 263.1158. Found: 263.1160.

EXAMPLE 1514-(4-Oxo-piperidin-1-yl)-benzoic acid

4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-benzoic acid (which was obtained in Example 150) (12.5 g, 47.5 mmol) was treated with concentrated hydrochloric acid (500 mL) at room temperature. After 15 hours ~28% ammonium hydroxide was added dropwise and the precipitate was collected by filtration, and dried over phosphorus pentoxide to give the title compound as a white solid (9.2 g, 88%); ¹H NMR (300 MHz, CDCl₃) δ 2.46 (t, J = 6.1 Hz, 4 H), 3.74 (t, J = 6.1 Hz, 4 H), 7.02 (d, J = 9.0 Hz, 2 H), 7.80 (d, J = 9.0 Hz, 2 H); MS (ES) m/z: 219.8 (MH⁺); HRMS Calcd. for C₁₂H₁₄NO₃(MH⁺): 220.0974. Found: 220.0947.

EXAMPLE 1522-[4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-malonic acid diethyl ester

A solution of 4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzaldehyde (2.47, 10 mmol) (Taylor, E. C., Skotnicki, J. S. *Synthesis*, **1981**, 606) and diethyl malonate (2.0g, 12.5 mmol) in toluene (100 mL) containing a catalytic quantity of piperidinium acetate was refluxed for 18 hours. After cooling to room temperature the solution was washed with water, dried over sodium sulfate and concentrated. Purification by column chromatography on silica gel using ethyl acetate/hexanes as the eluent gave the title compound as a yellowish gum; ¹H NMR (300 MHz, CDCl₃) δ 1.28 (t, J = 7.1 Hz, 3 H), 1.29 (t, J = 7.1 Hz, 3 H), 1.79 (t, J = 5.8 Hz, 4 H), 3.46 (t, J = 5.8 Hz, 4 H), 4.27 (q, J = 7.1 Hz, 2 H), 4.31 (q, J = 7.1 Hz, 2 H), 6.85 (d, J = 8.9 Hz, 2 H), 7.33 (d, J = 8.9 Hz, 2 H), 7.61 (s, 1 H); MS (ES) m/z: 390.0 (MH⁺); HRMS Calcd. for C₂₁H₂₇NO₆(MH⁺): 390.1911. Found: 390.1910.

EXAMPLE 1532-[4-(4-Oxo-piperidin-1-yl)-benzylidene]-malonic acid diethyl ester

The title compound was prepared from 2-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzylidene]-malonic acid diethyl ester (which was obtained in Example 152) according to the procedure of Example 147 as a yellowish gum; ¹H NMR (300 MHz, CDCl₃) δ 1.20-1.40 (m, 6 H), 2.56 (t, J = 6.1 Hz, 4 H), 3.73 (t, J = 6.1 Hz, 4 H), 4.28 (q, J = 7.1 Hz, 2 H), 4.46 (q, J = 7.1 Hz, 2 H), 6.90 (d, J = 8.9 Hz, 2 H), 7.41 (d, J = 8.9 Hz, 2 H), 7.41 (s, 1 H); MS (ES) m/z: 345.9 (MH⁺); HRMS Calcd. for C₂₁H₂₇NO₆(MH⁺): 346.1649. Found: 346.1647.

EXAMPLE 154N-(Benzyloxy)-4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)benzamide

A mixture of 4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzoic acid (which was obtained in Example 150) (1.58 g, 6 mmol), 1-[3-(dimethylamino)propyl-3-ethylcarbodiimide hydrochloride (1.34g, 7 mmol) and O-benzylhydroxyamine hydrochloride (1.05g, 6.6 mmol) was stirred in methylene chloride (150 mL). N-methylmorpholine (1.82 g, 18 mol) was added dropwise and the mixture was stirred overnight. The mixture was then washed with 0.05 N hydrochloric acid and water. The resulting solution was dried with magnesium sulfate and concentrated. The residue was crystallized from methylene chloride/hexanes to give the title compound as a white solid; ¹H NMR (300 MHz, CDCl₃) δ 1.67 (t, J = 5.6 Hz, 4 H), 3.42(t, J = 5.6 Hz, 4 H), 3.91(s, 4 H), 4.89(s, 2 H), 6.97 (d, J = 9.0 Hz, 2 H), 7.30-7.50(m, 5 H), 7.62 (d, J = 9.0 Hz, 2 H); MS (ES) m/z: 369.3 (MH⁺); HRMS Calcd. for C₂₁H₂₄N₂O₄(M⁺): 368.1736. Found: 368.1744.

EXAMPLE 155N-(Benzyloxy)-4-(4-oxo-piperidin-yl)benzamide

The title compound was prepared from N-(benzyloxy)-4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)benzamide (which was obtained in Example 154) according to the procedure of Example 147 as a grey solid; ¹H NMR (300 MHz, CDCl₃) δ 2.41 (t, J = 6.0 Hz, 4 H), 3.71(t, J = 6.0 Hz, 4 H), 4.89(s, 2 H), 7.19 (d, J = 9.0 Hz, 2 H), 7.30-7.50(m, 5 H), 7.67(d, J = 9.0 Hz, 2 H), 11.50 (s, 1 H); MS (ES) m/z: 325.4 (MH⁺); HRMS Calcd. for C₁₉H₂₁N₂O₃(MH⁺): 325.1552. Found: 325.1540.

EXAMPLE 156(2S)-2-[4-(4-Oxo-piperidin-1-yl)-benzoylamino]-pentanedioic acid dibenzyl ester

The title compound was prepared from 4-(4-oxo-piperidin-1-yl)-benzoic acid (which was obtained in Example 151) and L-glutamic acid dibenzyl ester p-tosylate according to the procedure of Example 154 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.90-2.20 (m, 4 H), 2.42 (t, J = 6.0 Hz, 4 H), 3.72(t, J = 6.0 Hz, 4 H), 4.45-4.55(m, 1 H), 5.07(s, 2 H), 5.13(s, 2 H), 7.03 (d, J = 9.0 Hz, 2 H), 7.25-7.40(m, 5 H), 7.85(d, J = 9.0 Hz, 2 H), 8.49(d, J = 9.0 Hz, 2 H); MS (ES) m/z: 529.1 (MH⁺); HRMS Calcd. for C₃₁H₃₃N₂O₆(MH⁺): 529.2339. Found: 529.2331.

EXAMPLE 157(2S)-2-[4-(4-Oxo-piperidin-1-yl)-benzoylamino]-pentanedioic acid diethyl ester

The title compound was prepared from 4-(4-oxo-piperidin-1-yl)-benzoic acid (which was obtained in Example 151) and L-glutamic acid diethyl ester hydrochloride according to the procedure of Example 154 as a yellowish gum; ¹H NMR (300 MHz, CDCl₃) δ 1.22 (t, J = 7.1 Hz, 3 H), 1.31 (t, J = 7.1 Hz, 3 H), 2.10-2.50 (m, 4 H), 2.57 (t, J = 6.1 Hz, 4 H), 3.73 (t, J = 6.1 Hz, 4 H), 4.10-4.30 (m, 4 H), 4.70-4.85 (m, 1 H), 6.90 (d, J = 7.5 Hz, 1 H), 7.08 (d, J = 8.9 Hz, 2 H), 7.78 (d, J = 8.9 Hz, 2 H); MS (ES) m/z: 405.3 (MH⁺).

EXAMPLE 1583-[4-(4-Oxo-piperidin-1-yl)-benzoylamino]-propionic acid ethyl ester

The title compound was prepared from 4-(4-oxo-piperidin-1-yl)-benzoic acid (which was obtained in Example 151) and beta-alanine ethyl ester hydrochloride according to the procedure of Example 154 as a yellowish solid; ¹H NMR (300 MHz, CDCl₃) δ 1.28 (t, J = 7.1 Hz, 3 H), 2.56 (t, J = 6.1 Hz, 4 H), 2.64 (t, J = 5.7 Hz, 2 H), 3.55-3.65 (m, 6 H), 4.15 (q, J = 7.1 Hz, 2 H), 6.82 (t, J = 5.7 Hz, 1 H), 6.95 (d, J = 8.9 Hz, 2 H), 7.70 (d, J = 8.9 Hz, 2 H); MS (ES) m/z: 319.1 (MH⁺).

EXAMPLE 1593-[4-(4-Oxo-piperidin-1-yl)-benzoylamino]-propionic acid benzyl ester

The title compound was prepared from 4-(4-oxo-piperidin-1-yl)-benzoic acid (which was obtained in Example 151) and beta-alanine benzyl ester p-tosylate according to the procedure of Example 154 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.42 (t, J = 6.0 Hz, 4 H), 2.63 (t, J = 6.9 Hz, 2 H), 3.40-3.50 (m, 2 H), 3.71 (t, J = 6.0 Hz, 4 H), 5.10 (s, 2 H), 6.74 (d, J = 8.9 Hz, 2 H), 7.30-7.40 (m, 5 H), 7.73 (d, J = 8.9 Hz, 2 H), 8.29 (t, J = 5.5 Hz, 1 H); MS (ES) m/z: 381.3 (MH⁺); HRMS Calcd. for C₂₂H₂₄N₂O₄(M⁺): 380.1737. Found: 380.1755.

EXAMPLE 1601-[4-(4-Oxo-piperidin-1-yl)-benzoyl]-pyrrolidine-(2S)-2-carboxylic acid methyl ester

The title compound was prepared from 4-(4-oxo-piperidin-1-yl)-benzoic acid (which was obtained in Example 151) and L-proline methyl ester hydrochloride according to the procedure of Example 154 as a pale yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.70-1.95 (m, 4 H), 2.20-2.40 (m, 1 H), 2.41 (t, J = 6.0 Hz, 4 H), 3.32 (s, 3 H), 3.69 (t, J = 6.0 Hz, 4 H), 4.35-4.50 (m,

2 H), 7.01 (d, J = 8.7 Hz, 2 H), 7.49(d, J = 8.7 Hz, 2 H); MS (ES) m/z: 331.2 (MH⁺); HRMS Calcd. for C₁₈H₂₂N₂O₄(M⁺): 330.1580. Found: 330.1572.

EXAMPLE 161

5 Ethyl {[4-(4-oxo-1-piperidiny)]benzoyl}amino}acetate

The title compound was prepared from 4-(4-oxo-piperidin-1-yl)-benzoic acid (which was obtained in Example 151) and glycine ethyl ester hydrochloride according to the procedure of Example 154 as a pale yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20 (t, J = 7.1 Hz, 3 H), 2.43 (t, J = 6.1 Hz, 4 H), 3.72 (t, J = 6.1 Hz, 4 H), 3.95 (d, J = 5.8 Hz, 2 H), 4.10 (q, J = 10 7.1 Hz, 2 H), 7.04 (d, J = 8.9 Hz, 2 H), 7.77(d, J = 8.9 Hz, 2 H), 8.63 (t, J = 5.8 Hz, 1 H); MS (ES) m/z: 305.2 (MH⁺); HRMS Calcd. for C₁₈H₂₂N₂O₄(M⁺): 304.1423. Found: 304.1422.

EXAMPLE 162

Methyl {[4-(4-oxo-1-piperidiny)]benzoyl}amino}acetate

15 The title compound was prepared from 4-(4-oxo-piperidin-1-yl)-benzoic acid (which was obtained in Example 151) and glycine methyl ester hydrochloride according to the procedure of Example 154 as a gum; MS (ES) m/z: 291.3 (MH⁺).

EXAMPLE 163

20 3-Methyl-(2S)-2-[4-(4-oxo-piperidin-1-yl)-benzoylamino]-butyric acid ethyl ester

The title compound was prepared from 4-(4-oxo-piperidin-1-yl)-benzoic acid (which was obtained in Example 151) and L-valine ethyl ester hydrochloride according to the procedure of Example 154 as a pale yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.93 (d, J = 6.8 Hz, 3 H), 0.97 (d, J = 6.8 Hz, 3 H), 1.20 (t, J = 7.1 Hz, 3 H), 2.10-2.30 (m, 1 H), 2.43 (t, J = 6.0 Hz, 25 4 H), 3.72 (t, J = 6.0 Hz, 4 H), 4.00-4.30(m, 4 H), 4.46 (t, J = 5.1 Hz, 1 H), 7.05 (d, J = 8.9 Hz, 2 H), 7.82(d, J = 8.9 Hz, 2 H), 8.21 (d, J = 7.9 Hz, 1 H); MS (ES) m/z: 347.3 (MH⁺); HRMS Calcd. for C₁₉H₂₆N₂O₄(M⁺): 346.1892. Found: 346.1896.

EXAMPLE 164

30 (2S)-2-[4-(4-Oxo-piperidin-1-yl)-benzoylamino]-3-phenyl-propionic acid methyl ester

The title compound was prepared from 4-(4-oxo-piperidin-1-yl)-benzoic acid (which was obtained in Example 151) and L-phenylalanine methyl ester hydrochloride according to the procedure of Example 154 as a pale yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.41 (t, J = 6.0 Hz, 4 H), 3.05-3.20 (m, 2 H), 3.71 (t, J = 6.0 Hz, 4 H), 4.55-4.65(m, 1 H), 6.97 (d, J =

8.9 Hz, 2 H), 7.10-7.45 (m, 5 H), 7.73(d, J = 8.9 Hz, 2 H), 8.52 (d, J = 7.8 Hz, 1 H); MS (ES) m/z: 381.3 (MH⁺); HRMS Calcd. for C₂₂H₂₅N₂O₄(MH⁺): 381.1809. Found: 380.1807.

EXAMPLE 165

5 4-Methyl-(2S)-2-[4-(4-oxo-piperidin-1-yl)-benzoylamino]-pentanoic acid ethyl ester

The title compound was prepared from 4-(4-oxo-piperidin-1-yl)-benzoic acid (which was obtained in Example 151) and L-leucine ethyl ester hydrochloride according to the procedure of Example 154 as a white flake; ¹H NMR (300 MHz, CDCl₃) δ 0.99(t, J = 6.2 Hz, 6 H), 1.30(t, J = 7.1 Hz, 3 H), 1.60-1.80(m, 3 H), 2.56(t, J = 6.0 Hz, 4 H), 3.72(t, J = 6.0 Hz, 4 H), 4.22(q, J = 10 7.1 Hz, 2 H), 4.80-4.90(m, 1 H), 6.42(d, J = 8.2 Hz, 1 H), 6.94(d, J = 7.0 Hz, 2 H), 7.77 (d, J = 7.0 Hz, 1 H); MS (ES) m/z: 361.3 (MH⁺); HRMS Calcd. for C₂₀H₂₈N₂O₄(M⁺): 360.2049. Found: 360.2081.

EXAMPLE 166

15 4-Methyl-(2S)-2-[4-(4-oxo-piperidin-1-yl)-benzoylamino]-pentanoic acid methyl ester

The title compound was prepared from 4-(4-oxo-piperidin-1-yl)-benzoic acid (which was obtained in Example 151) and L-leucine methyl ester hydrochloride according to the procedure of Example 154 as a gum; ¹H NMR (300 MHz, CDCl₃) δ 0.96(t, J = 6.2 Hz, 6 H), 1.60-1.80(m, 3 H), 2.57(t, J = 6.1 Hz, 4 H), 3.71(t, J = 6.1 Hz, 4 H), 3.77 (s, 3 H), 4.80-4.90(m, 1 H), 6.40(d, 20 J = 8.2 Hz, 1 H), 6.94(d, J = 7.0 Hz, 2 H), 7.75(d, J = 7.0 Hz, 1 H); MS (ES) m/z: 347.4 (MH⁺); HRMS Calcd. for C₁₉H₂₆N₂O₄(M⁺): 346.1892. Found: 346.1881.

EXAMPLE 167

Methyl 1-[4-(4-oxo-piperidin-1-yl)-benzoylamino]-cyclopropanecarboxylate

25 The title compound was prepared from 4-(4-oxo-piperidin-1-yl)-benzoic acid (which was obtained in Example 151) and 1-aminocyclopropane-1-carboxylic acid methyl ester hydrochloride according to the procedure of Example 154 as a gum; MS (ES) m/z: 317.2 (MH⁺).

30 **EXAMPLE 168**

(E)-3-[4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-phenyl]-acrylic acid ethyl ester

To a solution of lithium bromide (0.53 g, 6 mmol) in tetrahydrofuran (5 mL) was added triethyl phosphonoacetate (1.14 g, 5 mmol), followed by triethylamine (0.51 g, 5 mmol). After stirring for 10 min, a solution of 4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-benzaldehyde(Taylor, E.

C., Skotnicki, J. S. *Synthesis*, **1981**, 606) (1.24 g, 5 mmol) in tetrahydrofuran (2 mL) was added, and the mixture was stirred at room temperature for 20 hours. Additional triethyl phosphonoacetate (0.57 g, 2.5 mmol) and triethylamine (0.25 g, 2.5 mmol) were then added, and stirring was continued for 3 days. The mixture was evaporated, and the residue stirred with
5 20 mL of water and 5 mL of 1 N hydrochloric acid. The aqueous suspension was filtered, and the precipitate was washed with water, and dried in vacuo to give 1.28 g of a light yellow solid; m.p. 115–116 °C; ¹H NMR (CDCl₃) δ 1.33 (t, 3 H), 1.81 (dd, 4 H), 3.47 (dd, 4 H), 4.00 (s, 4 H), 4.25 (q, 2 H), 6.26 (d, 1 H), 6.89 (d, 2 H), 7.42 (d, 2 H), 7.62 (d, 1 H); MS (ES) m/z: 318 (MH⁺).

10 **EXAMPLE 169**

(E)-3-[4-(4-Oxo-piperidin-1-yl)-phenyl]-acrylic acid ethyl ester

Prepared according to Example 151 from 0.63 g (2 mmol) of 3-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-phenyl]-acrylic acid ethyl ester (which was obtained in Example 168), yielding 0.37 g of light yellow solid; m.p. 96–98 °C; ¹H NMR (CDCl₃) δ 1.33 (t, 3 H), 2.57 (t,
15 4 H), 3.71 (t, 4 H), 4.25 (q, 2 H), 6.28 (d, 1 H), 6.93 (d, 2 H), 7.47 (d, 2 H), 7.63 (d, 1 H); MS (ES) m/z: 274.3 (MH⁺).

EXAMPLE 170

(E)-3-[4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-phenyl]-acrylic acid

20 A solution of 0.52 g (1.6 mmol) of 3-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-phenyl]-acrylic acid ethyl ester (which was obtained in Example 168) in tetrahydrofuran (3 mL) and ethanol (2 mL) was treated with 5 mL of 1 N NaOH. After 18 h at room temperature, the mixture was acidified with acetic acid. The resulting suspension was filtered and the precipitate was washed with water, and dried in vacuo to give 0.47 g of light yellow solid; m.p.
25 221–222 °C; ¹H NMR (DMSO-d₆) δ 1.67 (dd, 4 H), 3.40 (dd, 4 H), 3.91 (s, 4 H), 6.26 (d, 1 H), 6.96 (d, 2 H), 7.47 (d, 1 H), 7.50 (d, 2 H), 12.10 (bs, 1 H); MS (ES) m/z: 290 (MH⁺).

EXAMPLE 171

(E)-3-[4-(4-Oxo-piperidin-1-yl)-phenyl]-acrylic acid

30 Prepared according to the procedure of Example 151 from 0.15 g (0.5 mmol) of 3-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-phenyl]-acrylic acid (which was obtained in Example 170), yielding 0.11 g of yellow solid; m.p. 215 °C; ¹H NMR (DMSO-d₆) δ 2.42 (t, 4 H), 3.71 (t, 4 H), 6.28 (d, 1 H), 7.01 (d, 2 H), 7.50 (d, 1 H), 7.55 (d, 2 H); MS (ES) m/z: 246.3 (MH⁺).

EXAMPLE 172**4-(1,4-Dioxo-8-azaspiro[4.5]dec-8-yl)-N-[(1S)-1-(hydroxymethyl)-3-methylbutyl]-benzamide**

The title compound was prepared from 4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)-benzoic acid (which was obtained in Example 150) (0.53 g, 2 mmol) and (S)-leucinol (0.30 g, 2.5 mmol) according to the procedure shown for Example 154 to give 0.53 g of a white solid; m.p. 90–91 °C; MS (ES) m/z: 363.3 (MH⁺); HRMS (ES) Calcd. for C₂₀H₃₁N₂O₄ (MH⁺): 363.2278, Found: 363.2275.

EXAMPLE 173**N-[(1S)-1-(Hydroxymethyl)-3-methylbutyl]-4-(4-oxo-1-piperidiny)benzamide**

Prepared according to the procedure of Example 151 from 0.22 g (0.6 mmol) of 4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)-N-[(1S)-1-(hydroxymethyl)-3-methylbutyl]benzamide (which was obtained in Example 172), yielding 0.15 g of light yellow foam; MS (ES) m/z: 319.3 (MH⁺); HRMS (ES) Calcd. for C₁₈H₂₇N₂O₃ (MH⁺): 319.2016, Found: 319.2016.

EXAMPLE 174**4-(1,4-Dioxo-8-azaspiro[4.5]dec-8-yl)-N-[(3S)-2-oxoazepanyl]benzamide**

The title compound was prepared from 4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)-benzoic acid (which was obtained in Example 150) (0.26 g, 1 mmol) and L-α-amino-ε-caprolactam (0.20 g, 1.5 mmol) according to the procedure shown for Example 154 to give 0.31 g of a white solid; m.p. 185–186 °C; MS (ES) m/z: 374.3 (MH⁺); HRMS (EI) Calcd. for C₂₀H₂₇N₃O₄ (M⁺): 373.2001, Found: 373.1995.

EXAMPLE 175**N-[(3S)-2-Oxoazepanyl]-4-(4-oxo-1-piperidiny)benzamide**

Prepared according to the procedure of Example 151 from 0.26 g (0.7 mmol) of 4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)-N-[(3S)-2-oxoazepanyl]benzamide (which was obtained in Example 174), yielding 0.19 g of a white solid; m.p. 177–179 °C; MS (ES) m/z: 330.3 (MH⁺); HRMS (EI) Calcd. for C₁₈H₂₃N₃O₃ (M⁺): 329.1740, Found: 329.1721.

EXAMPLE 176**N-Butyl-N-(cyanomethyl)-4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)benzamide**

The title compound was prepared from 4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)-benzoic acid (which was obtained in Example 150) (0.37 g, 1.4 mmol) and (n-butylamino)acetonitrile

(0.48 g, 4.2 mmol) according to the procedure shown for Example 154 to give 0.52 g of an amber gum; MS (ES) m/z: 358.3 (MH⁺); HRMS (ES) Calcd. for C₂₀H₂₈N₃O₃ (MH⁺): 358.2125, Found: 358.2120.

5 EXAMPLE 177

N-Butyl-4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)-N-(1H-tetraazol-5-oxa-8-azaspiro[4.5]dec-8-yl)-N-(1H-tetraazol-5-ylmethyl)benzamide

To a solution of N-butyl-N-(cyanomethyl)-4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)-benzamide (which was obtained in Example 176) (0.36 g, 1 mmol) in N,N'-dimethylpropyleneurea (3 mL) was added sodium azide (0.20 g, 3 mmol) and tiethylamine hydrochloride (0.21 g, 1.5 mmol). The mixture was stirred at 120 °C for 18 hours. It was then cooled to room temperature, diluted with water (30 mL), and saturated with sodium chloride. The resulting mixture was extracted with dichloromethane, and passed through a pad of silica gel. The filter pad was first eluted with ethyl acetate and 5% methanol in ethyl acetate, followed by 25% methanol in dichloromethane. Evaporation of solvents from the latter eluent and trituration with dichloromethane-ether gave 0.33 g of an off-white solid; m.p. 145–146 °C; MS (ES) m/z: 401.3 (MH⁺); HRMS (ES) Calcd. for C₂₀H₂₉N₆O₃ (MH⁺): 401.2296, Found: 401.2291.

EXAMPLE 178

N-Butyl-4-(4-oxo-1-piperidiny)-N-(1H-tetraazol-5-ylmethyl)benzamide

Prepared according to the procedure of Example 151 from 0.27 g (0.7 mmol) of N-butyl-4-(1,4-dioxo-8-azaspiro[4.5]dec-8-yl)-N-(1H-tetraazol-5-oxa-8-azaspiro[4.5]dec-8-yl)-N-(1H-tetraazol-5-ylmethyl)benzamide (which was obtained in Example 177), yielding 0.18 g of a colorless foam; MS (ES) m/z: 357.4 (MH⁺); HRMS (ES) Calcd. for C₁₈H₂₅N₆O₂ (MH⁺): 357.2034, Found: 357.2034.

EXAMPLE 179

N-{4-[4-[(2S)-2-Hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazole-4-yloxy)-propylamino]-piperidin-1-yl]}-benzoic acid ethyl ester

A mixture of 1-(4-ethoxycarbonylphenyl)-4-piperidone (0.25 g, 1 mmol) (Taylor, E. C., Skotnicki, J. S. *Synthesis*, **1981**, 606) and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (0.22g, 1 mmol)(US 5,786,356/1998) in 100 mL of ethanol and 0.5 mL of acetic acid was hydrogenated in the presence of 400 mg of 10% palladium on carbon under hydrogen (5 ~ 20 psi) for overnight. The catalyst was then removed by filtering through a short pad of silica gel. The filtrate was concentrated and purified by thin layer chromatography (12%

methanol/methylene chloride) to give the title compound as a white solid (0.22g, 48%); mp >170 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.28 (t, J = 7.0 Hz, 3 H), 1.30-1.55 (m, 2 H), 1.80-2.10 (m, 2 H), 2.80-3.10 (m, 5 H), 3.80-4.10 (m, 5 H), 4.23 (q, J = 7.0 Hz, 2 H), 6.58 (d, J = 7.8 Hz, 1 H), 6.62 (d, J = 8.4 Hz, 1 H), 6.86 (dd, J = 8.4, 7.8 Hz, 1 H), 6.98 (d, J = 8.6 Hz, 2 H), 7.77 (d, J = 8.6 Hz, 2 H), 10.60 (s, 1 H), 10.75 (s, 1 H); MS (ES) m/z: 455.1 (MH⁺); HRMS Calcd. for C₂₄H₃₀N₄O₅(MH⁺): 454.2216. Found: 454.2211.

EXAMPLE 180

{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoic acid ethyl ester

1-(4-Ethoxycarbonylphenyl)-4-piperidone (Taylor, E. C., Skotnicki, J. S. *Synthesis*, **1981**, 606)(0.29g, 1.2 mmol) and N-[5-(2-amino-(1R)-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10)(0.29g, 1.2 mmol) were mixed in dimethylformamide (10 mL) and then treated with sodium triacetoxyborohydride (1.01g, 4.7 mmol) and acetic acid (0.5 mL). After stirring at room temperature under a nitrogen atmosphere for 15 hours the mixture was poured into a saturated aqueous sodium bicarbonate. The precipitate which was formed was collected and purified by silica gel chromatography (methanol/methylene chloride) to give the titled compound as a white solid (0.28 g, 50%); mp >95 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.28 (t, J = 7.1 Hz, 3 H), 1.30-1.55 (m, 2 H), 1.80-1.95 (m, 2 H), 2.55-3.50 (m, 5 H), 2.92 (s, 3 H), 3.75-3.90 (m, 2 H), 4.22 (q, J = 7.1 Hz, 2 H), 6.82 (d, J = 8.2 Hz, 1 H), 6.95 (d, J = 8.9 Hz, 2 H), 7.00 (dd, J = 8.2, 1.9 Hz, 1 H), 7.18 (d, J = 1.9 Hz, 1 H), 7.75 (d, J = 8.9 Hz, 2 H); MS (ES) m/z: 478.0 (MH⁺); HRMS Calcd. for C₂₃H₃₂N₃O₆S(MH⁺): 478.2006. Found: 478.2000.

EXAMPLE 181

{4-[(2R)-2-(3-Chloro-phenyl)-2-hydroxy-ethylamino]-piperidin-1-yl}-benzoic acid ethyl ester hydrochloride

The free base was prepared from 1-(4-ethoxycarbonylphenyl)-4-piperidone (Taylor, E. C., Skotnicki, J. S. *Synthesis*, **1981**, 606) and (1R)-2-amino-1-(3-chloro-phenyl)-ethanol hydrochloride(which was obtained in Example 1) according to the procedure of Example 180. The hydrochloride salt was produced by the addition of hydrochloride gas as a white solid; mp >205 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.28 (t, J = 7.1 Hz, 3 H), 1.55-1.75 (m, 2 H), 2.05-2.25 (m, 2 H), 2.70-3.40 (m, 5 H), 3.95-4.10 (m, 2 H), 4.26 (q, J = 7.1 Hz, 2 H), 5.00-5.10 (m, 1 H), 7.06 (d, J = 9.0 Hz, 2 H), 7.30-7.60 (m, 3 H), 7.80 (d, J = 9.0 Hz, 2 H), 8.83

(br s, 1 H), 9.50 (br s, 1 H); MS (ES) m/z: 402.9 (MH⁺); HRMS Calcd. for C₂₂H₂₈ClN₂O₃(MH⁺): 403.1783. Found: 403.1780.

EXAMPLE 182

5 (4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-phenyl)-acetic acid

The title compound was prepared from [4-(4-oxo-piperidin-1-yl)-phenyl]-acetic acid (which was obtained in Example 149) and N-[5-(2-amino-(1R)-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure
10 of Example 179 as a pale yellowish solid; mp >140 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.25-1.40 (m, 2 H), 1.75-1.95 (m, 2 H), 2.50-3.60 (m, 7 H), 2.88 (s, 3 H), 3.16 (s, 2 H), 4.47 (dd, J = 8.0, 4.1 Hz, 1 H), 6.78 (d, J = 8.2 Hz, 1 H), 6.84 (d, J = 8.3 Hz, 2 H), 6.95 (dd, J = 8.2, 1.7 Hz, 1 H), 7.05 (d, J = 8.3 Hz, 2 H), 7.16 (d, J = 1.7 Hz, 1 H); MS (ES) m/z: 464.1 (MH⁺); HRMS Calcd. for C₂₂H₂₈N₃O₆S(M-H)⁻: 462.1704. Found: 462.1696.

EXAMPLE 183

(E)-3-(4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-phenyl)-acrylic acid ethyl ester

The title compound was prepared from (E)-3-[4-(4-oxo-piperidin-1-yl)-phenyl]-acrylic
20 acid ethyl ester (which was obtained in Example 169) (0.27 g, 1.0 mmol) and N-[5-((1R)-2-Amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) (0.27 g, 1.1 mmol) according to the procedure shown for Example 180 to give 0.40 g of yellow solid; m.p. 103–106 °C; ¹H NMR (DMSO-d₆) δ 1.24 (t, 3 H), 1.20-1.45 (m, 2 H), 1.75-1.95 (m, 2 H), 2.55-2.95 (m, 5 H), 2.92 (t, 3 H), 3.67-3.85 (m, 2 H), 4.14 (q, 2 H),
25 4.46-4.50 (m, 1 H), 6.34 (d, 1 H), 6.96 (d, 1 H), 6.79-7.05 (m, 3 H), 7.05 (d, 1 H), 7.17 (d, 1 H), 7.56 (d, 2 H); MS (ES) m/z: 504.0 (MH⁺).

EXAMPLE 184

30 3-(4-{4-[(R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-phenyl)-propionic acid

A solution of (E)-3-[4-(4-oxo-piperidin-1-yl)-phenyl]-acrylic acid (which was obtained in Example 170) (0.10 g, 0.40 mmol) and N-[5-((1R)-2-Amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methane-sulfonamide (which was obtained in Example 10) (0.12 g, 0.48 mmol) in methanol (15 mL) was treated with acetic acid (0.03 g, 0.5 mmol), and 0.05 g of 10% Pd/C. The mixture was

hydrogenated at 25 psi for 24 h, and then filtered through Celite and evaporated. The residue was triturated with ether to give 0.18 g of an off-white solid; m.p. 130–133 °C; ¹H NMR (DMSO-d₆) δ 1.30-1.46 (m, 2 H), 1.84-1.95 (m, 2 H), 2.37-2.50 (m, 4 H), 2.60-2.78 (m, 4 H), 2.92 (s, 3 H), 3.53-3.62 (m, 3 H), 4.46-4.55 (m, 1 H), 6.85 (d, 2 H), 6.92-7.10 (m, 4 H), 7.18 (dd, 1 H); MS (ES) m/z: 478.3 (MH⁺).

EXAMPLE 185

(4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzyloxy)-acetic acid

A solution of [4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-phenyl]-methanol (which was obtained in Example 148) (3.49g, 14 mmol) in tetrahydrofuran (100 mL) was treated with 60% sodium hydride in mineral oil (0.50, 21 mmol) and heated to a gentle reflux for 2 hours. After cooling to room temperature, iodoacetic acid sodium salt (2.91g, 14 mmol) was added in one portion. The resulting mixture was heated to a gentle reflux for another 2 hours. After cooling to room temperature the reaction was quenched by careful addition of water and then partitioned between water and methylene chloride. The aqueous layer was acidified by acetic acid and extracted with methylene chloride. The organic phase was dried over sodium sulfate, and concentrated. The residue was treated with concentrated hydrochloric acid (150 mL) at room temperature. After 3 hours the solution pH was adjusted to 4 by ~28% ammonium hydroxide. The aqueous layer was extracted with methylene chloride, and the combined organic phases were washed with water, dried over sodium sulfate and concentrated to give a gum (0.95g) [¹H NMR (300 MHz, CDCl₃) δ 2.55 (t, J = 6.1 Hz, 4 H), 3.61 (t, J = 6.1 Hz, 4 H), 4.10 (s, 2 H), 4.56 (s, 2 H), 6.95 (d, J = 8.6 Hz, 2 H), 7.29 (d, J = 8.6 Hz, 2 H); MS (ES) m/z: 264.3 (MH⁺)]. The gum (0.39g) was dissolved in methanol (100 mL)/acetic acid (0.5 mL) and mixed with N-[5-(2-amino-(1R)-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) (0.25g, 1 mmol). The resulting solution was hydrogenated in the presence of 500 mg of 10% palladium on carbon under hydrogen (5 ~ 20 psi) for 4 hours. The catalyst was then removed by filtering through a short pad of silica gel. The filtrate was concentrated and purified by silica gel chromatography (methanol/methylene chloride) to give the title compound as an off-white solid; mp >145 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.30-1.50 (m, 2H), 1.80-2.00 (m, 2 H), 2.60-2.80 (m, 5 H), 2.90 (s, 3 H), 3.50-3.70 (m, 2 H), 3.65 (s, 2 H), 4.52 (s, 2 H), 4.54 (dd, J = 8.3, 3.8 Hz, 1 H), 6.75-6.90 (m, 3 H), 7.00 (dd, J = 8.3, 2.0 Hz, 1 H), 7.02-7.20 (m, 3H); MS (ES) m/z: 494.2 (MH⁺); HRMS Calcd. for C₂₃H₃₀N₃O₇S(M-H)⁻: 492.1810. Found: 492.1804.

EXAMPLE 186

4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoic acid

- 5 The title compound was prepared from 4-(4-oxo-piperidin-1-yl)-benzoic acid (which was obtained in Example 151) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 179 as a white solid; mp >85 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.80-1.95 (m, 2 H), 2.60-3.00 (m, 5 H), 2.92 (s, 3 H), 3.75-3.85 (m, 2 H), 10 4.53 (dd, J = 8.3, 4.0 Hz, 1 H), 6.82 (d, J = 8.3 Hz, 1 H), 6.92 (d, J = 8.9 Hz, 2 H), 7.01 (dd, J = 8.3, 2.0 Hz, 1 H), 7.19 (d, J = 2.0 Hz, 1 H), 7.73 (d, J = 8.9 Hz, 2 H); MS (ES) m/z: 449.9 (MH⁺); HRMS Calcd. for C₂₁H₂₆N₃O₆S(M-H)⁻: 448.1549. Found: 448.1541.

EXAMPLE 187

- 15 3-(4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-phenyl)-propionic acid ethyl ester

- To a solution of (E)-3-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonyl-amino-phenyl)-ethylamino]-piperidin-1-yl}-phenyl)-acrylic acid ethyl ester (which was obtained in Example 183) (0.12g, 0.25 mmol) in ethanol (2 mL) and tetrahydrofuran (1 mL) was added 20 ammonium formate (0.16 g, 2.5 mmol), and 0.03 g of 10% Pd/C. The mixture was stirred at reflux for 18 hours. After cooling to room temperature, it was filtered through celite. The solvent was evaporated and the residue triturated with ether to give 0.11 g of a tan solid; m.p. 76–78°C; ¹H NMR (DMSO-d₆) δ 1.15 (t, 3 H), 1.20-1.40 (m, 2 H), 1.81-1.89 (m, 2 H), 2.50-2.75 (m, 9 H), 2.91 (t, 3 H), 3.45-3.60 (m, 2 H), 4.03 (q, 2 H), 4.46-4.50 (m, 1 H), 6.80-6.84 (m, 25 3 H), 6.98-7.04 (m, 3 H), 7.17 (d, 1 H)); MS (ES) m/z: 506.0 (MH⁺).

EXAMPLE 188

2-(4-{4-[2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzylidene)-malonic acid diethyl ester

- 30 The title compound was prepared from 2-[4-(4-oxo-piperidin-1-yl)-benzylidene]-malonic acid diethyl ester (which was obtained in Example 153) and N-[5-(-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 9) according to the procedure of Example 180 as a yellowish solid; mp >80 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.21 (t, J = 7.0 Hz, 3 H), 1.23 (t, J = 7.0 Hz, 3 H), 1.75-1.95 (m, 2 H), 2.50-3.50

(m, 7 H), 2.92 (s, 3 H), 3.75-3.90 (m, 2 H), 4.21 (q, J = 7.0 Hz, 2 H), 4.31 (q, J = 7.0 Hz, 2 H), 4.47 (dd, J = 8.0, 4.2 Hz, 1 H), 6.81 (d, J = 8.2 Hz, 1 H), 6.94 (d, J = 9.0 Hz, 2 H), 7.00 (dd, J = 8.2, 2.0 Hz, 1 H), 7.17 (d, J = 2.0 Hz, 1 H), 7.33 (d, J = 9.0 Hz, 2 H), 7.52 (s, 1 H); MS (ES) m/z: 576.1 (MH⁺); HRMS Calcd. for C₂₈H₃₈N₃O₈S(MH⁺): 576.2374. Found: 576.2375.

5

EXAMPLE 189

2-(4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzylidene)-malonic acid monoethyl ester

2-(4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzylidene)-malonic acid diethyl ester was prepared from 2-[4-(4-oxo-piperidin-1-yl)-benzylidene]-malonic acid diethyl ester (which was obtained in Example 153) and N-[5-(2-amino-(1R)-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 180 as a yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.21 (t, J = 7.0 Hz, 3 H), 1.23 (t, J = 7.0 Hz, 3 H), 1.75-1.95 (m, 2 H), 2.50-3.50 (m, 7 H), 2.90 (s, 3 H), 3.75-3.90 (m, 2 H), 4.16 (q, J = 7.0 Hz, 2 H), 4.29 (q, J = 7.0 Hz, 2 H), 4.47 (dd, J = 8.0, 4.2 Hz, 1 H), 6.84 (d, J = 8.2 Hz, 1 H), 6.94 (d, J = 9.0 Hz, 2 H), 7.00 (dd, J = 8.2, 2.0 Hz, 1 H), 7.17 (d, J = 2.0 Hz, 1 H), 7.33 (d, J = 9.0 Hz, 2 H), 7.52 (s, 1 H); MS (ES) m/z: 576.0 (MH⁺); HRMS Calcd. for C₂₈H₃₈N₃O₈S(MH⁺): 576.2374. Found: 576.2373.

The title compound was prepared by sodium hydroxide hydrolysis of the above diethyl ester as a pale grey solid; mp >170 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.21 (t, J = 7.0 Hz, 3 H), 1.40-1.60 (m, 2 H), 1.90-2.05 (m, 2 H), 2.93 (s, 3 H), 2.70-4.00 (m, 7 H), 4.65-4.75 (m, 1 H), 6.86 (d, J = 8.1 Hz, 1 H), 6.93 (d, J = 8.9 Hz, 2 H), 7.07 (dd, J = 8.1, 2.0 Hz, 1 H), 7.15-7.30 (m, 4 H); MS (ES) m/z: 547.9 (MH⁺); HRMS Calcd. for C₂₆H₃₄N₃O₈S(MH⁺): 548.2061. Found: 548.2057.

EXAMPLE 190

4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzamide

The title compound was prepared from 4-(4-oxo-piperidin-1-yl)-benzamide (which was obtained in Example 147) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 180 as a white solid; mp >75 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.2-1.40 (m, 2 H), 1.70-1.90 (m, 2 H), 2.55-2.95 (m, 5 H), 2.97 (s, 3 H), 3.70-3.85 (m, 2 H), 4.48

(dd, J = 8.0, 4.3 Hz, 1 H), 6.81 (d, J = 8.2 Hz, 1 H), 6.91 (d, J = 9.0 Hz, 2 H), 6.99 (dd, J = 8.2, 2.0 Hz, 1 H), 7.17 (d, J = 2.0 Hz, 1 H), 7.67 (br s, 2 H), 7.72 (d, J = 9.0 Hz, 2 H); MS (ES) m/z: 448.9 (MH⁺); HRMS Calcd. for C₂₁H₂₉N₄O₅S (MH⁺): 449.1853. Found: 449.1853.

5 EXAMPLE 191

N-Benzyloxy-4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzamide

The title compound was prepared from N-benzyloxy-4-(4-oxo-piperidin-1-yl)-benzamide(which was obtained in Example 155) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide(which was obtained in Example 10) according to the procedure of Example 180 as a white solid; mp >70 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.2-1.40 (m, 2 H), 1.70-1.90 (m, 2 H), 2.50-2.95 (m, 5 H), 2.92 (s, 3 H), 3.70-3.85 (m, 2 H), 4.47 (dd, J = 8.0, 4.2 Hz, 1 H), 4.89 (s, 2 H), 6.81 (d, J = 8.2 Hz, 1 H), 6.92 (d, J = 9.0 Hz, 2 H), 7.00 (dd, J = 8.2, 2.0 Hz, 1 H), 7.18 (d, J = 2.0 Hz, 1 H), 7.30-7.50 (m, 5 H), 7.60 (d, J = 9.0 Hz, 2 H); MS (ES) m/z: 555.3 (MH⁺); HRMS Calcd. for C₂₈H₃₅N₄O₆S (MH⁺): 555.2272. Found: 555.2260.

EXAMPLE 192

Diethyl(2S)-2-[4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)-amino]phenyl}ethyl)-amino]-1-piperidinyl}benzoyl)amino]pentanedioate

The title compound was prepared from (2S)-2-[4-(4-oxo-piperidin-1-yl)-benzoylamino]-pentanedioic acid diethyl ester (which was obtained in Example 157) and N-[5-((1R)-2-amino-1-hydroxy- ethyl)-2-hydroxy-phenyl]-methanesulfonamide(which was obtained in Example 10) according to the procedure of Example 180 as a white solid; mp >75 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.18 (t, J = 7.1 Hz, 3 H), 1.19 (t, J = 7.1 Hz, 3 H), 1.20-1.45 (m, 2H), 1.80-2.10 (m, 4 H), 2.41 (t, J = 7.4 Hz, 2 H), 2.50-2.95 (m, 5 H), 2.93 (s, 3 H), 3.75-3.85 (m, 2 H), 4.05 (q, J = 7.1 Hz, 2 H), 4.10 (q, J = 7.1 Hz, 2 H), 4.35-4.45 (m, 1 H), 4.45-4.55 (m, 1 H), 6.82 (d, J = 8.3 Hz, 1 H), 6.94 (d, J = 8.9 Hz, 2 H), 7.01 (dd, J = 8.3, 2.0 Hz, 1 H), 7.18 (d, J = 2.0 Hz, 1 H), 7.74 (d, J = 8.9 Hz, 2 H), 8.38 (d, J = 7.5 Hz, 1 H); MS (ES) m/z: 635.1 (MH⁺); HRMS Calcd. for C₃₀H₄₃N₄O₉S (MH⁺): 635.2745. Found: 635.2735.

EXAMPLE 193

Ethyl 3-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}benzoyl)amino]propanoate

The title compound was prepared from 3-[4-(4-oxo-piperidin-1-yl)-benzoylamino]-propionic acid ethyl ester (which was obtained in Example 158) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 179 as a white solid; mp >95 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.17 (t, J = 7.1 Hz, 3 H), 1.40-1.60 (m, 2 H), 1.90-2.10 (m, 2 H), 2.54 (t, J = 7.0 Hz, 2 H), 2.70-2.95 (m, 5 H), 2.94 (s, 3 H), 3.35-3.50 (m, 2 H), 3.80-3.95 (m, 2H), 4.05 (q, J = 7.1 Hz, 2 H), 4.65-4.75 (m, 1 H), 6.88 (d, J = 8.2 Hz, 1 H), 6.95 (d, J = 8.9 Hz, 2 H), 7.05 (dd, J = 8.2, 1.9 Hz, 1 H), 7.22 (d, J = 1.9 Hz, 1 H), 7.69 (d, J = 8.9 Hz, 2 H), 8.26 (t, J = 5.2 Hz, 1 H); MS (ES) m/z: 549.2 (MH⁺); HRMS Calcd. for C₂₆H₃₇N₄O₇S (MH⁺): 549.2377. Found: 549.2369.

EXAMPLE 194

(2S)-2-[(4-{4-[(2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl) amino]phenyl}-ethyl)amino]-1-piperidinyl}benzoyl)amino]pentanedioic acid

The title compound was prepared from (2S)-2-[4-(4-oxo-piperidin-1-yl)-benzoylamino]-pentanedioic acid dibenzyl ester (which was obtained in Example 156) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 179 as a white solid; mp >230 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.60 (m, 2 H), 1.90-2.10 (m, 4 H), 2.31 (t, J = 7.5 Hz, 2 H), 2.65-3.20 (m, 7 H), 3.00 (s, 3 H), 3.85-4.00 (m, 2 H), 4.25-4.35 (m, 1 H), 4.65-4.80 (m, 1 H), 6.88 (d, J = 8.4 Hz, 1 H), 6.95 (d, J = 8.7 Hz, 2 H), 7.08 (dd, J = 8.4, 1.2 Hz, 1 H), 7.25 (d, J = 1.8 Hz, 1 H), 7.74 (d, J = 8.7 Hz, 2 H), 8.14 (d, J = 7.2 Hz, 1 H); MS (ES) m/z: 579.1 (MH⁺); HRMS Calcd. for C₂₆H₃₅N₄O₉S (MH⁺): 579.1973. Found: 579.1955.

EXAMPLE 195

N-(4-{4-[(2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}benzoyl)-beta-alanine

The title compound was prepared from 3-[4-(4-oxo-piperidin-1-yl)-benzoylamino]-propionic acid benzyl ester (which was obtained in Example 159) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 179 as a white solid; mp >170 °C (decomposed); ¹H

NMR (300 MHz, DMSO-d₆) δ 1.20-1.45 (m, 2 H), 1.80-1.95 (m, 2 H), 2.43 (t, J = 7.0 Hz, 2 H), 2.60-2.90 (m, 5 H), 2.90 (s, 3 H), 3.00-3.40 (m, 2 H), 3.70-3.85 (m, 2 H), 4.50 (dd, J = 8.0, 4.2 Hz, 1 H), 6.82 (d, J = 8.3 Hz, 1 H), 6.92 (d, J = 8.9 Hz, 2 H), 7.01 (dd, J = 8.3, 1.9 Hz, 1 H), 7.18 (d, J = 1.9 Hz, 1 H), 7.68 (d, J = 8.9 Hz, 2 H), 8.26 (t, J = 5.2 Hz, 1 H); MS (ES) m/z: 521.2 (MH⁺); HRMS Calcd. for C₂₄H₃₃N₄O₇S (MH⁺): 521.2064. Found: 521.2056.

EXAMPLE 196

Ethyl[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}benzoyl)amino]acetate

The title compound was prepared from ethyl {[4-(4-oxo-1-piperidinyl)benzoyl]amino} acetate (which was obtained in Example 161) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 180 as a white solid; mp >140 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.20 (t, J = 7.1 Hz, 3 H), 1.20-1.35 (m, 2 H), 1.75-1.90 (m, 2 H), 2.50-2.90 (m, 5 H), 2.90 (s, 3 H), 3.70-3.85 (m, 2 H), 3.93 (d, J = 5.8 Hz, 2 H), 4.10 (q, J = 7.1 Hz, 2 H), 4.47 (dd, J = 7.9, 4.4 Hz, 1 H), 6.79 (d, J = 8.3 Hz, 1 H), 6.90-7.00 (m, 3 H), 7.16 (d, J = 2.0 Hz, 1 H), 7.72 (d, J = 8.9 Hz, 2 H), 8.58 (t, J = 5.8 Hz, 1 H); MS (ES) m/z: 535.2 (MH⁺); HRMS Calcd. for C₂₆H₃₇N₄O₇S (MH⁺): 535.2221. Found: 535.2216.

EXAMPLE 197

[(4-{4-[(2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}benzoyl)amino]acetic acid

The title compound was prepared from ethyl [(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}benzoyl)amino]acetate (which was obtained in Example 196) by sodium hydroxide hydrolysis as a white solid; mp >85°C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.75-1.90 (m, 2 H), 2.55-2.90 (m, 5 H), 2.80 (s, 3 H), 3.49 (d, J = 4.5 Hz, 2 H), 3.70-3.80 (m, 2 H), 4.43 (dd, J = 7.9, 4.4 Hz, 1 H), 6.70 (d, J = 7.4 Hz, 1 H), 6.81 (dd, J = 7.4, 2.0 Hz, 1 H), 6.92 (d, J = 8.9 Hz, 2 H), 7.12 (d, J = 2.0 Hz, 1 H), 7.54 (t, J = 4.5 Hz, 1 H), 7.64 (d, J = 8.9 Hz, 2 H); MS (ES) m/z: 507.2 (MH⁺); HRMS Calcd. for C₂₃H₃₁N₄O₇S (MH⁺): 507.1908. Found: 507.1912.

EXAMPLE 198

(2S)-2-(4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoylamino)-4-methyl-pentanoic acid ethyl ester:

The title compound was prepared from ethyl 4-methyl-2-[(2S)-4-(4-oxo-piperidin-1-yl)-benzoylamino]-pentanoic acid ethyl ester (which was obtained in Example 165) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 180 as an off-white solid; mp >85 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 0.86 (d, J = 6.3 Hz, 3 H), 0.92 (d, J = 6.3 Hz, 3 H), 1.18 (t, J = 7.1 Hz, 3 H), 1.20-1.40 (m, 2 H), 1.45-1.95 (m, 5 H), 2.55-2.92 (m, 5 H), 2.92 (s, 3 H), 3.70-3.85 (m, 2 H), 4.10 (q, J = 7.1 Hz, 2 H), 4.40-4.55 (m, 2 H), 6.82 (d, J = 8.3 Hz, 1 H), 6.94 (d, J = 8.9 Hz, 2 H), 7.00 (dd, J = 8.3, 2.0 Hz, 1 H), 7.18 (d, J = 2.0 Hz, 1 H), 7.75 (d, J = 8.9 Hz, 2 H), 8.33 (d, J = 7.7 Hz, 1 H); MS (ES) m/z: 591.3 (MH⁺); HRMS Calcd. for C₂₉H₄₃N₄O₇S (MH⁺): 591.2847. Found: 591.2840.

EXAMPLE 199

(2S)-2-(4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoylamino)-4-methyl-pentanoic acid

The title compound was prepared from 2-(4-{4-[2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoylamino)-4-methyl-pentanoic acid ethyl ester (which was obtained in Example 198) by sodium hydroxide hydrolysis as a white solid; mp >177 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 0.87 (d, J = 6.3 Hz, 3 H), 0.90 (d, J = 6.3 Hz, 3 H), 1.35-1.75 (m, 5 H), 1.90-2.00 (m, 2 H), 2.60-2.90 (m, 5 H), 2.94 (s, 3 H), 3.65-3.80 (m, 2 H), 4.25-4.35 (m, 1 H), 4.60-4.65 (m, 1 H), 6.85 (d, J = 8.3 Hz, 1 H), 6.90 (d, J = 8.9 Hz, 2 H), 7.05 (dd, J = 8.3, 1.9 Hz, 1 H), 7.21 (d, J = 1.9 Hz, 1 H), 7.73 (d, J = 8.9 Hz, 2 H), 7.98 (d, J = 7.7 Hz, 1 H); MS (ES) m/z: 561.3 (M-H)⁻; HRMS Calcd. for C₂₇H₃₇N₄O₇S (M-H)⁻: 561.2377. Found: 561.2381.

EXAMPLE 200

1-(4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoyl)-pyrrolidine-(2S)-2-carboxylic acid methyl ester

The title compound was prepared from 1-[4-(4-oxo-piperidin-1-yl)-benzoyl]-pyrrolidine-(2S)-2-carboxylic acid methyl ester (which was obtained in Example 160) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 180 as an off-white solid; mp >80 °C

(decomposed); ^1H NMR (300 MHz, DMSO- d_6) δ 1.20-1.40 (m, 2 H), 1.75-1.95 (m, 4 H), 2.15-2.30 (m, 2 H), 2.50-2.90 (m, 5 H), 2.90 (s, 3 H), 3.55-3.80 (m, 7 H), 4.40-4.55 (m, 2 H), 6.81 (d, $J = 8.3$ Hz, 1 H), 6.92 (d, $J = 8.7$ Hz, 2 H), 6.98 (dd, $J = 8.3, 2.0$ Hz, 1 H), 7.17 (d, $J = 2.0$ Hz, 1 H), 7.43 (d, $J = 8.7$ Hz, 2 H); MS (ES) m/z : 561.3 (MH^+); HRMS Calcd. for $\text{C}_{27}\text{H}_{37}\text{N}_4\text{O}_7\text{S}$ (MH^+): 561.2377. Found: 561.2369.

EXAMPLE 201

1-(4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoyl)-pyrrolidine-(2S)-2-carboxylic acid

The title compound was prepared from 1-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoyl)-pyrrolidine-(2S)-2-carboxylic acid methyl ester (which was obtained in Example 200) by sodium hydroxide hydrolysis as a white solid; mp >220 °C (decomposed); ^1H NMR (300 MHz, DMSO- d_6) δ 1.20-1.40 (m, 2 H), 1.75-1.95 (m, 4 H), 2.50-2.90 (m, 7 H), 2.62 (s, 3 H), 3.50-4.00 (m, 5 H), 4.35-4.45 (m, 1 H), 6.60 (d, $J = 8.3$ Hz, 1 H), 6.79 (d, $J = 8.7$ Hz, 2 H), 6.90 (dd, $J = 8.2$ Hz, 1 H), 7.06 (d, $J = 1.4$ Hz, 1 H), 7.37 (d, $J = 8.6$ Hz, 2 H); MS (ES) m/z : 545.6 (M-H^-); HRMS Calcd. for $\text{C}_{26}\text{H}_{33}\text{N}_4\text{O}_7\text{S}$ (M-H^-): 545.2075. Found: 545.2064.

EXAMPLE 202

(2S)-2-(4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoylamino)-3-methyl-butyric acid ethyl ester

The title compound was prepared from 3-methyl-(2S)-2-[4-(4-oxo-piperidin-1-yl)-benzoylamino]-butyric acid ethyl ester (which was obtained in Example 163) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 180 as an off-white solid; mp >85 °C (decomposed); ^1H NMR (300 MHz, DMSO- d_6) δ 0.92 (d, $J = 6.8$ Hz, 3 H), 0.97 (d, $J = 6.8$ Hz, 3 H), 1.17 (t, $J = 7.1$ Hz, 3 H), 1.20-1.40 (m, 2 H), 1.75-1.95 (m, 2 H), 2.05-2.20 (m, 1 H), 2.55-2.90 (m, 5 H), 2.90 (s, 3 H), 3.70-3.85 (m, 2 H), 4.00-4.20 (m, 2 H), 4.22 (t, $J = 7.7$ Hz, 1 H), 4.48 (dd, $J = 8.0, 4.4$ Hz, 1 H), 6.80 (d, $J = 8.2$ Hz, 1 H), 6.95 (d, $J = 8.9$ Hz, 2 H), 6.98 (dd, $J = 8.2, 2.0$ Hz, 1 H), 7.17 (d, $J = 2.0$ Hz, 1 H), 7.76 (d, $J = 8.9$ Hz, 2 H), 8.17 (d, $J = 7.9$ Hz, 1 H); MS (ES) m/z : 577.2 (MH^+); HRMS Calcd. for $\text{C}_{29}\text{H}_{43}\text{N}_4\text{O}_7\text{S}$ (MH^+): 577.2690. Found: 577.2682.

EXAMPLE 203

(2S)-2-(4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoylamino)-3-methyl-butyric acid

The title compound was prepared from (2S)-2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoylamino)-3-methyl-butyric acid ethyl ester (which was obtained in Example 202) by sodium hydroxide hydrolysis as a pale yellowish solid; mp >135 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 0.90 (d, J = 2.3 Hz, 3 H), 0.92 (d, J = 2.3 Hz, 3 H), 1.45-1.55 (m, 2 H), 1.90-2.05 (m, 2 H), 2.05-2.20 (m, 1 H), 2.60-2.94 (m, 5 H), 2.94 (s, 3 H), 3.70-3.85 (m, 2 H), 4.11 (t, J = 6.0 Hz, 1 H), 4.65-4.75 (m, 1 H), 6.86 (d, J = 8.3 Hz, 1 H), 6.91 (d, J = 8.9 Hz, 2 H), 7.06 (dd, J = 8.3, 2.0 Hz, 1 H), 7.22 (d, J = 2.0 Hz, 1 H), 7.65-7.75 (m, 3 H); MS (ES) m/z: 549.3 (MH⁺); HRMS Calcd. for C₂₆H₃₅N₄O₇S (M-H)⁻: 547.2231. Found: 547.2229.

EXAMPLE 204

(2S)-2-(4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoylamino)-3-phenyl-propionic acid methyl ester

The title compound was prepared from (2S)-2-[4-(4-oxo-piperidin-1-yl)-benzoylamino]-3-phenyl-propionic acid methyl ester (which was obtained in Example 164) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 180 as an off-white solid; mp >98 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.80-1.90 (m, 2 H), 2.05-2.90 (m, 5 H), 2.91 (s, 3 H), 3.00-3.20 (m, 2 H), 3.70-3.80 (m, 2 H), 4.47 (dd, J = 8.0, 4.3 Hz, 1 H), 4.50-4.65 (m, 1 H), 6.81 (d, J = 8.2 Hz, 1 H), 6.92 (d, J = 8.9 Hz, 2 H), 7.00 (dd, J = 8.2, 2.0 Hz, 1 H), 7.10-7.30 (m, 6 H), 7.67 (d, J = 8.9 Hz, 2 H), 8.47 (d, J = 7.8 Hz, 1 H); MS (ES) m/z: 611.2 (MH⁺); HRMS Calcd. for C₃₁H₃₉N₄O₇S (MH⁺): 611.2534. Found: 611.2525.

EXAMPLE 205

(2S)-2-(4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoylamino)-3-phenyl-propionic acid

The title compound was prepared from (2S)-2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoylamino)-3-phenyl-propionic acid methyl ester (which was obtained in Example 204) by sodium hydroxide hydrolysis as a pale yellowish solid; mp >160 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.50 (m, 2 H), 1.90-2.05 (m, 2 H), 2.50-3.50 (m, 7 H), 2.95 (s, 3 H), 3.69-3.75 (m, 2 H), 4.30-4.45

(m, 2 H), 4.70-4.75 (m, 1 H), 6.83 (d, J = 8.8 Hz, 2 H), 6.88 (d, J = 8.3 Hz, 1 H), 7.05-7.30 (m, 7 H), 7.63 (d, J = 8.8 Hz, 2 H), 7.93 (br d, J = 6.6 Hz, 1 H); MS (ES) m/z: 597.1 (MH⁺); HRMS Calcd. for C₃₀H₃₅N₄O₇S (M-H)⁻: 595.2231. Found: 595.2232.

5 EXAMPLE 206

Methyl 1-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-piperidinyl}benzoyl)amino]cyclopropane-carboxylate

The title compound was prepared from methyl 1-[4-(4-oxo-piperidin-1-yl)-benzoyl-amino]cyclopropanecarboxylate (which was obtained in Example 167) and N-[5-((1R)-2-amino-10 1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 180 as a white solid; mp >110 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.05-1.40 (m, 6 H), 1.75-1.90 (m, 2 H), 2.55-2.91 (m, 5 H), 2.91 (s, 3 H), 3.58(s, 3 H), 3.69-3.80 (m, 2 H), 4.47 (dd, J = 7.9, 4.4 Hz, 1 H), 6.81 (d, J = 8.5 Hz, 1 H), 6.85 (d, J = 8.9 Hz, 2 H), 7.00 (dd, J = 8.5, 2.0 Hz, 1 H), 7.17 (d, J = 2.0 Hz, 1 H), 7.71 (d, 15 J = 8.9 Hz, 1 H), 8.72 (s, 1 H); MS (ES) m/z: 547.1 (MH⁺); HRMS Calcd. for C₂₆H₃₅N₄O₇S (MH⁺): 547.2221. Found: 547.2218.

EXAMPLE 207

20 [Butyl-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoyl)-amino]-acetic acid ethyl ester

A mixture of 4-(4-oxo-piperidin-1-yl)-benzoic acid (which was obtained in Example 151) (0.30 g, 1.37 mmol), 1-[3-(dimethylamino)propyl-3-ethylcarbodiimide hydrochloride (0.53, 2.74 mmol) and N-butylglycine ethyl ester (0.44g, 2.7 mmol) was stirred in methylene chloride (70 mL). N-methylmorpholine (0.28 g, 2.74 mol) was added dropwise and the mixture was stirred 25 overnight. The mixture was then washed with 0.05 N hydrochloric acid and water. The resulting solution was dried with magnesium sulfate and concentrated to give a gum. The gum was dissolved in dimethylformamide (15 mL) and then treated with N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (0.25g, 1 mmol) (which was obtained in Example 10), sodium triacetoxyborohydride (0.85g, 4 mmol) and acetic acid (0.3 mL). After 30 stirring at room temperature under a nitrogen atmosphere for 2 hours the mixture was poured into a saturated aqueous sodium bicarbonate. The aqueous layer was extracted with n-butanol and the concentrated gum was purified by silica gel chromatography (methanol/methylene chloride) to give the title compound as a white solid; mp >60 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 0.70-1.60 (m, 12 H), 1.75-1.95 (m, 2 H), 2.50-3.50 (m, 7 H), 2.91 (s, 3 H),

3.60-3.75 (m, 2 H), 4.00-4.15 (m, 4 H), 4.47 (dd, J = 8.0, 4.3 Hz, 1 H), 6.81 (d, J = 8.5 Hz, 1 H), 6.90-7.00 (m, 3 H), 7.05-7.25 (m, 3 H); MS (ES) m/z: 591.3 (MH⁺); HRMS Calcd. for C₂₉H₄₃N₄O₇S (MH⁺): 591.2847. Found: 591.2840.

5 EXAMPLE 208

Methyl[4-(4-(((2R)-2-hydroxy-2-(4-hydroxy-3-((methylsulfonyl)amino)phenyl)ethyl)amino)-1-piperidinyl)benzoyl]amino]acetate

The title compound was prepared from methyl {[4-(4-oxo-1-piperidinyl)benzoyl]amino}-acetate (which was obtained in Example 162) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 180 as a white solid; mp >75 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.35 (m, 2 H), 1.75-1.90 (m, 2 H), 2.50-2.90 (m, 5 H), 2.91 (s, 3 H), 3.63 (s, 3 H), 3.70-3.85 (m, 2 H), 3.95(d, J = 5.7 Hz, 2 H), 4.49 (dd, J = 8.0, 4.3 Hz, 1 H), 6.81 (d, J = 8.2 Hz, 1 H), 6.96(d, J = 8.9 Hz, 2 H), 7.00 (dd, J = 8.2, 2.0 Hz, 1 H), 7.17 (d, J = 2.0 Hz, 1 H), 7.71 (d, J = 8.9 Hz, 2 H), 8.60 (t, J = 5.8 Hz, 1 H); MS (ES) m/z: 521.3 (MH⁺); HRMS Calcd. for C₂₅H₃₇N₄O₇S (M⁺): 520.2064. Found: 520.2054.

EXAMPLE 209

(2S)-2-(4-[4-[2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl]-benzoylamino)-4-methyl-pentanoic acid methyl ester

The title compound was prepared from methyl 4-methyl-2-[(2S)-4-(4-oxo-piperidin-1-yl)-benzoylamino]-pentanoic acid methyl ester (which was obtained in Example 166) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 180 as a white solid; mp >90 °C (decomposed); ¹H NMR (300 MHz, DMSO-d₆) δ 0.86 (d, J = 6.4 Hz, 3 H), 0.92 (d, J = 6.4 Hz, 3 H), 1.20-1.40 (m, 2 H), 1.50-1.95 (m, 5 H), 2.55-2.92 (m, 5 H), 2.91 (s, 3 H), 3.62 (s, 3 H), 3.70-3.85 (m, 2 H), 4.40-4.55 (m, 2 H), 6.82 (d, J = 8.2 Hz, 1 H), 6.93 (d, J = 8.9 Hz, 2 H), 7.00 (dd, J = 8.2, 2.0 Hz, 2 H), 7.18 (d, J = 2.0 Hz, 1 H), 7.75 (d, J = 8.9 Hz, 2 H), 8.34 (d, J = 7.7 Hz, 1 H); MS (ES) m/z: 577.3 (MH⁺); HRMS Calcd. for C₂₈H₄₁N₄O₇S (MH⁺): 577.2690. Found: 577.2682.

EXAMPLE 210

(2E)-3-(4-{4-[(2R)-2-Hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-phenyl)-acrylic acid

A solution of 0.10 g (0.2 mmol) of (E)-3-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-phenyl)-acrylic acid ethyl ester (which was obtained in Example 183) in ethanol (3 mL) was treated with 3 mL of 1 N NaOH. After 18 h at room temperature, the mixture was acidified with acetic acid. The resulting suspension was filtered and the precipitate was washed with water, and dried in vacuo to give 0.09 g of a tan solid; m.p. 220 °C; ¹H NMR (DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.80-1.95 (m, 2 H), 2.57-2.95 (m, 5 H), 2.92 (t, 3 H), 3.74-3.82 (m, 2 H), 4.48-4.52 (m, 1 H), 6.22 (s, 1 H), 6.27 (s, 1 H), 6.81-7.03 (m, 4 H), 7.18 (d, 1 H), 7.42-7.49 (m, 3 H); MS (ES) m/z: 476.0 (MH⁺).

EXAMPLE 211

4-{4-[(2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}-N-[(1S)-1-(hydroxymethyl)-3-methylbutyl]benzamide

The title compound was prepared from N-[(1S)-1-(hydroxymethyl)-3-methylbutyl]-4-(4-oxo-1-piperidinyl)benzamide (which was obtained in Example 173) (0.13 g, 0.4 mmol) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (0.12 g, 0.48 mmol) (which was obtained in Example 10) according to the procedure shown for Example 180 to give 0.16 g of an off-white solid; m.p. 120–122 °C; MS (ES) m/z: 549.3 (MH⁺); HRMS (ES) Calcd. for C₂₇H₄₁N₄O₆S (MH⁺): 549.2741, Found: 549.2735.

EXAMPLE 212

4-{4-[(2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-sulfonyl)-amino]phenyl}ethyl)amino]-1-piperidinyl}-N-[(3S)-2-ethylamino]-1-piperidinyl}-N-[(3S)-2-oxoazepanyl]benzamide

The title compound was prepared from N-[(3S)-2-oxoazepanyl]-4-(4-oxo-1-piperidinyl)-benzamide (which was obtained in Example 175) (0.13 g, 0.4 mmol) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) (0.12 g, 0.48 mmol) according to the procedure shown for Example 180 to give 0.20 g of an off-white solid; m.p. 135–137 °C; MS (ES) m/z: 560.2 (MH⁺); HRMS (ES) Calcd. for C₂₇H₃₈N₅O₆S (MH⁺): 560.2537, Found: 560.2531.

EXAMPLE 213

N-Butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}-N-(1H-tetraazol-5-ylmethyl)benzamide

The title compound was prepared from N-butyl-4-(4-oxo-1-piperidinyl)-N-(1H-tetraazol-5-ylmethyl)benzamide (which was obtained in Example 178) (0.14 g, 0.4 mmol) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) (0.12 g, 0.48 mmol) according to the procedure shown for Example 180 to give 0.22 g of an off-white solid; m.p. 168–170 °C; MS (ES) m/z: 587.5 (MH⁺); HRMS (ES) Calcd. for C₂₇H₃₉N₈O₅S (MH⁺): 587.2759, Found: 587.2751.

EXAMPLE 214

4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-phenylamine

A mixture of 8-(4-nitro-phenyl)-1,4-dioxo-8-aza-spiro[4.5]decane (Synthesis, 606, 1981) (3.5 g, 13.3 mmol) and 10% Pd/C (0.5 g) in 100 mL of ethanol/methylene chloride(2:1) was pressurized with 30 psi hydrogen and shaken over 1 hours. The catalyst was then removed by filtering through a short pad of silica gel to give the title compound (2.8g, 90%) as a grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.85-2.00 (m, 4 H), 3.00-3.10 (m, 4 H), 3.93 (s, 4 H), 6.60 (d, J = 6.0 Hz, 2 H), 6.80 (d, J = 6.0 Hz, 2 H); MS (ES) m/z: 235.2 (MH⁺); HRMS Calcd. for C₁₃H₁₈N₂O₂: 234.1380. Found: 234.1371.

EXAMPLE 215

N-{4-[4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-phenylsulfamoyl]-phenyl}-acetamide

To a stirred solution of 4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-phenylamine (which was obtained in Example 214) (2.8g, 11.9mmol) in 1,4-dioxane (150 mL) and triethylamine (7 mL) was added a solution of N-acetylsulfanilyl chloride (3.5g, 15 mmol) in 75 mL of 1,4-dioxane at room temperature. The reaction was stirred for 18 hours. The reaction mixture was concentrated. The residue was dissolved in methylene chloride and washed with diluted hydrochloric acid. The white solid in water layer was collected and dried to give the title compound as a white solid (2.5g, 43%); ¹H NMR (300 MHz, DMSO-d₆) δ 1.92 (brs, 4 H), 2.06 (s, 3 H), 3.68 (brs, 4 H), 3.93 (s, 4 H), 7.06 (d, J = 8.4 Hz, 2 H), 7.33 (brs, 2 H), 7.68 (d, J = 9.0 Hz, 2 H), 7.71 (d, J = 9.0Hz, 2 H), 10.24 (brs, 1 H), 10.38 (s, 1 H); MS (ES) m/z: 432.3 (MH⁺); HRMS Calcd. for C₂₁H₂₅N₃O₅S(M⁺): 431.1515. Found: 431.1530.

EXAMPLE 216N-[4-[4-(4-Oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl]-acetamide

N-[4-[4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-phenylsulfamoyl]-phenyl]-acetamide (which was obtained in Example 215) (2.2 g, 5.1 mmol) was treated with concentrated hydrochloric acid (50 mL) at 0 °C and then allowed to warm to room temperature. After 30 min., ~20 mL of 5 N NaOH was added dropwise and the precipitate was collected by filtration, and dried over P₂O₅ to give the title compound as a white solid (1.2 g); ¹H NMR (300 MHz, DMSO-d₆) δ 2.06 (s, 3 H), 2.43 (t, J = 5.8 Hz, 4 H), 3.53 (t, J = 5.8 Hz, 4 H), 6.85-7.05 (m, 4 H), 7.62 (d, J = 9.0 Hz, 2 H), 7.71 (d, J = 9.0 Hz, 2 H), 9.81 (s, 1 H), 10.35 (s, 1 H); MS (ES) m/z: 388.3 (MH⁺); HRMS Calcd. for C₁₉H₂₁N₃O₄S(M⁺):387.1253. Found: 387.1272.

EXAMPLE 217N-[4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-phenyl]-4-methoxy-benzenesulfonamide

The title compound was prepared from 4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-phenylamine (which was obtained in Example 214) and 4-methoxybenzenesulfonyl chloride according to the procedure of Example 215 as a crystalline solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.65 (t, J = 5.6 Hz, 4 H), 3.15 (t, J = 5.6 Hz, 4 H), 3.79 (s, 3 H), 3.88 (s, 4 H), 6.79 (d, J = 9.0 Hz, 2 H), 6.88 (d, J = 9.0 Hz, 2 H), 7.02 (d, J = 9.0 Hz, 2 H), 7.60 (d, J = 9.0 Hz, 2 H), 9.63 (s, 1 H); MS (ES) m/z: 405.3 (MH⁺); HRMS Calcd. for C₂₀H₂₄N₂O₅S(M⁺): 404.1406. Found: 404.1402. Anal. Calcd. for C₂₀H₂₄N₂O₅S: C, 59.39; H, 5.98; N, 6.93. Found: C, 59.48; H, 6.03; N, 6.85.

EXAMPLE 2184-Methoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]benzenesulfonamide

The title compound was prepared from N-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-phenyl]-4-methoxy-benzenesulfonamide (which was obtained in Example 217) according to the procedure of Example 216 as a grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.37 (t, J = 6.0 Hz, 4 H), 3.50 (t, J = 6.0 Hz, 4 H), 3.79 (s, 3 H), 6.88 (d, J = 9.0 Hz, 2 H), 6.93 (d, J = 9.0 Hz, 2 H), 7.01 (d, J = 9.0 Hz, 2 H), 7.60 (d, J = 9.0 Hz, 2 H), 9.66 (s, 1 H); MS (ES) m/z: 361.2 (MH⁺); HRMS Calcd. for C₁₈H₂₀N₂O₄S(M⁺): 360.1144. Found: 360.1146.

EXAMPLE 2198-(2-Nitro-phenyl)-1,4-dioxo-8-aza-spiro[4.5]decane

A solution of 2-fluoronitrobenzene (10 g, 70.9 mmol) and 1,4-dioxo-8-aza-spiro[4.5]-
decane (10 g, 69.8 mmol) in pyridine (70 mL) was heated at 70 °C for 1 day, diluted with water,
5 and extracted with ethyl acetate. The combined organic extracts were washed with brine, dried
with sodium sulfate, and filtered. The solvent was removed under reduced pressure to give the
title compound (15 g) as a red oil; ¹H NMR (300 MHz, CDCl₃) δ 1.88 (t, J = 5.6 Hz, 4 H), 3.16
(t, J = 5.6 Hz, 4 H), 4.00 (s, 4 H), 7.03 (dd, J = 8.2, 8.2 Hz, 2 H), 7.17 (d, J = 8.2 Hz, 2 H), 7.40
(ddd, J = 8.2, 8.2, 1.7 Hz, 1 H), 7.77 (dd, J = 8.4, 1.7 Hz, 1 H); MS (ES) m/z: 265.1 (MH⁺);
10 HRMS Calcd. for C₁₃H₁₇N₂O₄(MH⁺): 265.1188. Found: 265.1164.

EXAMPLE 2202-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-phenylamine hydrochloride

A mixture of 8-(2-nitro-phenyl)-1,4-dioxo-8-aza-spiro[5.5]decane (which was obtained in
15 Example 219) (14.1 g, 15.9 mmol) and 10% Pd/C (1 g) in 100 mL of ethanol was pressurized
with 30 psi hydrogen and shaken over 2 hours. The catalyst was then removed by filtering
through a short pad of silica gel. Hydrogen chloride (1.0 M solution in diethyl ether) was added
and the solid that formed was collected by filtration to give the title compound as a white solid;
¹H NMR (300 MHz, DMSO-d₆) δ 1.85-2.00 (m, 4 H), 3.00-3.40 (m, 4 H), 3.93 (s, 4 H), 7.12-
20 7.28 (m, 2 H), 7.28-7.55 (m, 2 H); MS (ES) m/z: 235.2 (MH⁺); HRMS Calcd. for
C₁₃H₁₉N₂O₂(MH⁺): 235.1447. Found: 235.1451.

EXAMPLE 221N-{4-[2-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-phenylsulfamoyl]-phenyl}-acetamide

25 The title compound was prepared from 2-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-
phenylamine hydrochloride (which was obtained in Example 220) and N-acetylsulfanilyl
chloride according to the procedure of Example 215 as a crystalline solid; ¹H NMR (300 MHz,
DMSO-d₆) δ 1.73 (t, J = 5.4 Hz, 4 H), 2.73 (t, J = 5.4 Hz, 4 H), 3.33 (s, 4 H), 3.89 (s, 3 H),
7.00-7.10 (m, 2 H), 7.10-7.20 (m, 1 H), 7.30-7.40 (m, 1 H), 7.67 (d, J = 9.3 Hz, 2 H), 7.71 (d,
30 J = 9.3 Hz, 2 H), 8.79 (s, 1 H), 10.29 (s, 1 H); MS (ES) m/z: 432.2 (MH⁺); HRMS Calcd. for
C₂₁H₂₆N₃O₅S (MH⁺): 432.1593. Found: 432.1597. Anal. Calcd. for C₂₁H₂₅N₃O₅S: C, 58.45;
H, 5.84; N, 9.74. Found: C, 58.41; H, 5.83; N, 9.72.

EXAMPLE 222N-{4-[2-(4-Oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide

The title compound was prepared from N-{4-[2-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 221) according to the
5 procedure of Example 216 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.05 (s, 3 H), 2.43 (t, J = 5.9 Hz, 4 H), 2.77 (t, J = 5.9 Hz, 4 H), 7.00-7.20 (m, 3 H), 7.35-7.45 (m, 1 H), 7.64 (d, J = 6.9 Hz, 2 H), 7.71 (d, J = 6.9 Hz, 2 H), 9.10 (s, 1 H), 10.30 (s, 1 H); MS (ES) m/z: 388.3 (MH⁺); HRMS Calcd. for C₁₉H₂₂N₃O₄S (MH⁺): 388.1331. Found: 388.1341.

10 EXAMPLE 223N-[4-(1,4-Dioxo-8-aza-spiro[4.5]dec-8-yl)-phenyl]-4-(3-hexyl-ureido)-benzenesulfonamide

The title compound was prepared from 4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-phenylamine (which was obtained in Example 214) and 4-(3-hexyl-ureido)benzenesulfonyl chloride (US 5,561,142/1996) according to the procedure of Example 215 as a white flake; ¹H
15 NMR (300 MHz, DMSO-d₆) δ 0.86 (t, J = 6.5 Hz, 3 H), 1.20-1.50 (m, 8 H), 1.65 (t, J = 5.7 Hz, 4 H), 3.00-3.10 (m, 2 H), 3.14 (t, J = 5.7 Hz, 4 H), 3.88 (s, 4 H), 6.28 (t, J = 5.6 Hz, 1 H), 6.79 (d, J = 9.0 Hz, 2 H), 6.87 (d, J = 9.0 Hz, 2 H), 7.45 (d, J = 9.1 Hz, 2 H), 7.51 (d, J = 9.1 Hz, 2 H), 8.82 (s, 1 H); MS (ES) m/z: 517.2 (MH⁺); HRMS Calcd. for C₂₆H₃₇N₄O₅S (MH⁺): 517.2485. Found: 517.2377. Anal. Calcd. for C₂₆H₃₆N₄O₅S: C, 60.44; H, 7.02; N, 10.84.

20 Found: C, 60.29; H, 6.95; N, 10.91.

EXAMPLE 2241-(4-Amino-phenyl)-piperidin-4-one hydrochloride

A mixture of 1-(4-nitro-phenyl)-piperidin-4-one (Synthesis 1981, 606) (4.0 g, 18 mmol)
25 and 500 mg of 10% Pd/C in 75 mL of methylene chloride was hydrogenated under H₂ (5 ~ 10 psi) for 1 hour. The catalyst was then removed by filtering through a short pad of silica gel. The filtrate was treated with hydrogen chloride gas and the precipitate was collected to give 2 g of the title compound as a tan solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.44 (t, J = 6.0 Hz, 4 H), 3.65 (t, J = 6.0 Hz, 4 H), 7.14 (d, J = 9.0 Hz, 2 H), 7.25 (d, J = 9.0 Hz, 2 H); MS (ES) m/z:
30 190.9 (MH⁺); HRMS Calcd. for C₁₁H₁₅N₂O (MH⁺): 190.1106. Found: 190.1096.

EXAMPLE 2254-(3-Hexyl-ureido)-N-[4-(4-oxo-piperidin-1-yl)-phenyl]benzenesulfonamide

Method A: The title compound was prepared from N-[4-(1,4-dioxo-8-aza-spiro[4.5]dec-8-yl)-phenyl]-4-(3-hexyl-ureido)-benzenesulfonamide (which was obtained in Example 223) according to the procedure of Example 216 a as a grey solid.

Method B: To a stirred solution of 1-(4-amino-phenyl)-piperidin-4-one hydrochloride (which was obtained in Example 224) (3.95 g, 15 mmol) in 250 mL of dioxane was added 13.7 mL of triethylamine followed by 4-(3-hexylureido)benzenesulfonyl chloride (US 5,561,142-1996) (6.36 g, 20 mmol). After being stirred over 1 day, the mixture was concentrated and the residue chromatographed on silica gel (0 to 10% methanol/methylene chloride) to afford 3.0 g of the title compound; ^1H NMR (300 MHz, CDCl_3) δ 0.88 (t, J = 7.0 Hz, 3 H), 1.20-1.60 (m, 8 H), 2.45-2.60 (m, 4 H), 3.20-3.75 (m, 2 H), 3.50-3.60 (m, 4 H), 4.90 (brs, 1 H), 6.50 (brs, 1 H), 6.82 (d, J = 8.5 Hz, 2 H), 6.97 (d, J = 8.5 Hz, 2 H), 7.38 (d, J = 8.7 Hz, 2 H), 7.56 (d, J = 8.7 Hz, 2 H); MS (ES) m/z: 473.5 (MH^+); HRMS Calcd. for $\text{C}_{24}\text{H}_{25}\text{N}_4\text{O}_4\text{S}$ (MH^+): 473.2233. Found: 473.2220.

EXAMPLE 2264-[4-(3-Cyclopentyl-propyl)-5-oxo-4,5-dihydro-tetrazol-1-yl]-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide

The title compound was prepared from 1-(4-amino-phenyl)-piperidin-4-one (which was obtained in Example 224) and 4-[(3-cyclopentyl-propyl)-5-oxo-4,5-dihydro-tetrazol-1-yl]-phenylsulfonyl chloride (US 5,561,142/1996) according to the Method B of Example 225 as a yellowish solid; ^1H NMR (300 MHz, $\text{DMSO}-d_6$) δ 0.90-1.80 (m, 17 H), 2.36 (t, J = 6.0 Hz, 2 H), 3.49 (t, J = 6.0 Hz, 2 H), 3.96 (t, J = 7.0 Hz, 2 H), 6.86 (d, J = 6.7 Hz, 2 H), 6.94 (d, J = 6.7 Hz, 2 H), 7.86 (d, J = 8.8 Hz, 2 H), 8.06 (d, J = 8.8 Hz, 2 H), 9.92 (s, 1 H); MS (ES) m/z: 525.1 (MH^+); HRMS Calcd. for $\text{C}_{26}\text{H}_{32}\text{N}_6\text{O}_4\text{S}$ (M^+): 524.2205. Found: 524.2193. Anal. Calcd. for $\text{C}_{26}\text{H}_{32}\text{N}_6\text{O}_4\text{S}$: C, 59.52; H, 6.15; N, 16.02. Found: C, 59.50; H, 6.28; N, 15.81.

EXAMPLE 2275-Pyridin-2-yl-thiophene-2-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide

The title compound was prepared from 5-pyridin-2-yl-thiophene-2-sulphonyl chloride and 1-(4-amino-phenyl)-piperidin-4-one (which was obtained in Example 224) according to the procedure B of Example 225 as a white solid; ^1H NMR (300 MHz, $\text{DMSO}-d_6$) δ 2.37 (t, J = 6.0

Hz, 4 H), 3.52 (t, J = 6.0 Hz, 4 H), 6.89 (d, J = 9.0 Hz, 2 H), 7.02 (d, J = 9.0 Hz, 2 H), 7.39 (dd, J = 4.2, 1.5 Hz, 1 H), 7.42 (d, J = 2.1 Hz, 1 H), 7.76 (d, J = 2.1 Hz, 1 H), 7.90 (dd, J = 7.8, 1.5 Hz, 1 H), 8.00 (d, J = 7.8 Hz, 1 H), 8.53 (d, J = 4.2 Hz, 1 H), 10.05 (s, 1 H); MS (ES) m/z: 413.9 (MH⁺); HRMS Calcd. for C₂₀H₁₉N₃O₃S₂(M⁺): 413.0867. Found: 413.0877.

5

EXAMPLE 228Butane-1-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide

The title compound was prepared from 1-butanefulfonyl chloride and 1-(4-amino-phenyl)-piperidin-4-one hydrochloride (which was obtained in Example 224) according to the
10 procedure B of Example 225 as a crystalline solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.83 (t, J = 7.3 Hz, 3 H), 1.25-1.40 (m, 2 H), 1.55-1.70 (m, 2 H), 2.40 (t, J = 5.9 Hz, 4 H), 2.94 (t, J = 7.6 Hz, 2 H), 3.54 (t, J = 5.9 Hz, 4 H), 7.00 (d, J = 9.0 Hz, 2 H), 7.09 (d, J = 9.0 Hz, 2 H), 9.34 (s, 1 H); MS (ES) m/z: 311.0 (MH⁺); HRMS Calcd. for C₁₅H₂₂N₂O₂S(M⁺): 310.1351. Found: 310.1375. Anal. Calcd. for C₁₅H₂₂N₂O₂S: C, 58.04; H, 7.14; N, 9.02. Found: C, 57.78; H, 6.95;
15 N, 8.83.

EXAMPLE 2295-(5-Trifluoromethyl-pyridin-2-sulfonyl)thiophene-2-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide

The title compound was prepared from 5-(5-trifluoromethyl-pyridin-2-sulfonyl)-thiophene-2-sulphonyl chloride and 1-(4-amino-phenyl)-piperidin-4-one (which was obtained in Example 224) according to the procedure B of Example 225 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.37 (t, J = 4.5 Hz, 4 H), 3.52 (t, J = 4.5 Hz, 4 H), 6.90-7.10 (m, 4 H), 7.90 (d, J = 1.2 Hz, 1 H), 8.41 (d, J = 6.3 Hz, 1 H), 8.50 (d, J = 1.2 Hz, 1 H), 8.62 (dd, J = 6.3, 1.5
25 Hz, 1 H), 9.23 (s, 1 H), 9.89 (s, 1 H); MS (ES) m/z: 545.9 (MH⁺); HRMS Calcd. for C₂₁H₁₉F₃N₃O₅S₃(MH⁺): 546.0439. Found: 546.0466. Anal. Calcd. for C₂₁H₁₈F₃N₃O₅S₃: C, 46.23; H, 3.33; N, 7.70. Found: C, 46.46; H, 3.39; N, 7.35.

EXAMPLE 230Octane-1-sulfonic acid [4-(4-oxo-1-piperidiny)-phenyl]-amide

The title compound was prepared from 1-octanesulfonyl chloride and 1-(4-amino-phenyl)-piperidin-4-one hydrochloride (which was obtained in Example 224) according to the procedure B of Example 225 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.84 (t, J = 5.4 Hz, 3 H), 1.15-1.40 (m, 10 H), 1.60-1.75 (m, 2 H), 2.40 (t, J = 4.5 Hz, 4 H), 2.94 (t, J = 5.7 Hz,

2 H), 3.54 (t, J = 4.5 Hz, 4 H), 6.99 (d, J = 6.9 Hz, 2 H), 7.09 (d, J = 6.9 Hz, 2 H), 9.31 (s, 1 H); MS (ES) m/z: 367.0 (MH⁺); HRMS Calcd. for C₁₉H₃₀N₂O₂S(M⁺): 366.1977. Found: 366.1969. Anal. Calcd. for C₁₉H₃₀N₂O₂S: C, 62.26; H, 8.25; N, 7.64. Found: C, 62.40; H, 7.98; N, 7.59.

5 EXAMPLE 231

4-(2,4-Dioxo-thiazolidin-5-ylmethyl)-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide

The title compound was prepared from 4-(2,4-dioxo-thiazolidin-5-ylmethyl)benzenesulfonylchloride (*J. Med. Chem.* **1992**, 35, 1853) and 1-(4-amino-phenyl)-piperidin-4-one hydrochloride (which was obtained in Example 224) according to the procedure B of Example 10 225 as a yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.37 (t, J = 6.0 Hz, 4 H), 3.10-3.60 (m, 2 H), 3.44 (t, J = 6.0 Hz, 4 H), 4.95 (dd, J = 12.3, 6.0 Hz, 1 H), 6.80-7.00 (m, 4 H), 7.27 (d, J = 8.1 Hz, 2 H), 7.63 (d, J = 8.1 Hz, 2 H), 9.77 (brs, 1 H), 12.09 (brs, 1 H); MS (ES) m/z: 459.9 (MH⁺); HRMS Calcd. for C₂₁H₂₁N₃O₅S₂ M⁺: 459.0923. Found: 459.0930.

15 EXAMPLE 232

{4-[4-(4-Oxo-piperidin-1-yl)-phenylsulfamoyl]-phenoxy}-acetic acid methyl ester

The title compound was prepared from (4-chlorosulfonyl-phenoxy)-acetic acid methyl ester (*Chem. Pharm. Bull.* **1995**, 43, 1132) and 1-(4-amino-phenyl)-piperidin-4-one hydrochloride (which was obtained in Example 224) according to the procedure B of Example 20 225 as a grey solid; MS (ES) m/z: 418.9 (MH⁺); HRMS Calcd. for C₂₀H₂₃N₂O₆S(MH⁺): 419.1271. Found: 419.1271.

EXAMPLE 233

4-[4-(4-Oxo-piperidin-1-yl)-phenylsulfamoyl]-benzoic acid

25 The title compound was prepared from 4-(chlorosulfonyl)benzoic acid and 1-(4-amino-phenyl)-piperidin-4-one hydrochloride (which was obtained in Example 224) according to the procedure B of Example 225 as a pale grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.36 (t, J = 6.0 Hz, 4 H), 3.49 (t, J = 6.0 Hz, 4 H), 6.87 (d, J = 9.3 Hz, 2 H), 6.91 (d, J = 9.3 Hz, 2 H), 7.77 (d, J = 8.1 Hz, 2 H), 8.04 (d, J = 8.1 Hz, 2 H), 9.97 (s, 1 H), 13.10 (brs, 1 H); MS (ES) m/z: 30 374.9 (MH⁺); HRMS Calcd. for C₁₈H₁₉N₂O₅S(MH⁺): 375.1009. Found: 375.1009.

EXAMPLE 234**3-[4-(4-Oxo-piperidin-1-yl)-phenylsulfamoyl]-thiophene-2-carboxylic acid methyl ester**

The title compound was prepared from 2-(methoxycarbonyl)thiophene-3-sulphonyl chloride and 1-(4-amino-phenyl)-piperidin-4-one hydrochloride (which was obtained in Example 224) according to the procedure B of Example 225 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.37 (t, J = 6.0 Hz, 4 H), 3.50 (t, J = 6.0 Hz, 4 H), 3.89 (s, 3 H), 6.90 (d, J = 9.1 Hz, 2 H), 6.96 (d, J = 9.1 Hz, 2 H), 7.33 (d, J = 6.9 Hz, 1 H), 7.90 (d, J = 6.9 Hz, 1 H), 9.50 (s, 1 H); MS (ES) m/z: 395.0 (MH⁺); HRMS Calcd. for C₁₇H₁₉N₂O₅S₂(MH⁺): 395.0736. Found: 395.0721.

EXAMPLE 235**4-[4-(4-Oxo-piperidin-1-yl)-phenylsulfamoyl]-benzoic acid ethyl ester**

A stirred solution of 4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-benzoic acid (which was obtained in Example 234) (1.4 g, 3.74 mmol) in 50 mL of ethanol was treated with hydrochloride gas at room temperature. After four hours the solution was concentrated and the residue was dissolved in concentrated hydrochloric acid (200 mL) at room temperature. After another 3 hours the pH was adjusted to ~ 5 and the precipitate was collected by filtration, and dried over P₂O₅ to give the title compound as a yellowish solid (1.1 g, 70%); ¹H NMR (300 MHz, CDCl₃) δ 1.40 (t, J = 7.1 Hz, 3 H), 2.36 (t, J = 6.0 Hz, 4 H), 3.56 (t, J = 6.0 Hz, 4 H), 4.41 (q, J = 7.1 Hz, 2 H), 6.82 (d, J = 8.9 Hz, 2 H), 6.97 (d, J = 8.9 Hz, 2 H), 7.78 (d, J = 8.3 Hz, 2 H), 8.07 (d, J = 8.3 Hz, 2 H); MS (ES) m/z: 403.2 (MH⁺); HRMS Calcd. for C₂₀H₂₃N₂O₅S(MH⁺): 403.1328. Found: 403.1330.

EXAMPLE 236**[4-(4-Oxo-piperidin-1-yl)-phenylsulfamoyl]-acetic acid benzyl ester**

The title compound was prepared from benzyloxycarbonylmethylsulfonylchloride (*J. Antibiot.*, **1994**, 47, 1041) and 1-(4-amino-phenyl)-piperidin-4-one (which was obtained in Example 224) according to the procedure B of Example 225 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.42 (t, J = 6.0 Hz, 4 H), 3.55 (t, J = 6.0 Hz, 4 H), 4.16 (s, 2 H), 5.16 (s, 2 H), 6.99 (d, J = 9.0 Hz, 2 H), 7.10 (d, J = 9.0 Hz, 2 H), 9.73 (s, 1 H); MS (ES) m/z: 403.2 (MH⁺); HRMS Calcd. for C₂₀H₂₂N₂O₅S(M⁺): 402.1250. Found: 402.1237.

EXAMPLE 237Pyridine-3-sulfonic acid[4-(4-oxo piperidin-1-yl)-phenyl] amide

To a stirred solution of 1-(4-amino-phenyl)-piperidin-4-one hydrochloride (which was obtained in Example 224) (8.76g, 0.32mol) in methylene chloride (100 mL) at room temperature was added triethylamine (9 mL). To this mixture was added a mixture of 3-pyridinesulfonyl chloride (7.45g, 0.035mol) and triethylamine (9 mL). The reaction was stirred for 18 hours. The reaction mixture was concentrated. The product was flash silica gel chromatographed eluting with 7:3 ethyl acetate/hexanes and then flash silica gel chromatographed eluting with 3% methanol in methylene chloride to give the titled compound as a yellow solid (1.34g, 13%); ^1H NMR (300 MHz, CDCl_3) δ 2.54(t, J = 6 Hz, 4 H), 3.56(t, J = 6 Hz, 4 H), 6.79(s, 1 H), 6.85(d, J = 12 Hz, 2 H), 6.98(d, J = 12 Hz, 2 H), 7.40(m, 1H), 7.97(dd, J = 3 Hz, 1 H), 8.75(dd, J = 6 Hz, 1 H), 8.90(d, J = 3 Hz, 1 H); MS (ES) m/z: 331.9 (MH^+ , 100%); HRMS Calcd. for $\text{C}_{16}\text{H}_{17}\text{N}_3\text{O}_3\text{S}(\text{MH}^+)$: 332.1063. Found: 332.1063.

EXAMPLE 2385-Chloro-3-methyl-benzo[b]thiophene-2-sulfonic acid [4-(4-oxo-piperidin-1-yl)phenyl]amide:

The title compound was prepared according to the procedure of Example 225 as a light yellow solid; ^1H NMR (300 MHz, CDCl_3) δ 2.53 (t, J = 6.06 Hz, 4H), 2.81 (s, 3H), 3.56 (t, J = 6.06 Hz, 4H), 6.39 (s, 1H), 6.82 (d, 1H), 7.02 (d, 1H), 7.57 (dd, J = 2.01 Hz, 8.70 Hz, 1H), 7.70-7.71 (m, 1H), 7.80 (s, 1H), 7.83 (s, 1H), 7.90 (d, J = 2.16 Hz, 1H); MS (ES) m/z: 434.8 (MH^+).

EXAMPLE 2394-Cyano-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide

The title compound was prepared according to the procedure of Example 225 as a yellow solid; ^1H NMR (300 MHz, CDCl_3) δ 2.56 (t, J = 6.09 Hz, 2H), 3.58 (t, J = 6.03 Hz, 2H), 6.42 (s, 1H), 6.80-6.88 (m, 2H), 6.93-6.98 (m, 2H), 7.69-7.75 (m, 1H), 7.79-7.89 (m, 2H), 8.06-8.10 (m, 1H); MS (ES) m/z: 355.9 (MH^+).

EXAMPLE 2403-Bromo-5-chloro-thiophene-2-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide

The title compound was prepared according to the procedure of Example 225 as an olive-green foam; ^1H NMR (300 MHz, CDCl_3) δ 2.54 (t, J = 6.06 Hz, 4H), 3.60 (t, J = 6.03 Hz, 4H), 6.79 (s, 1H), 6.83-6.91 (m, 2H), 6.92-6.95 (m, 1H), 7.07-7.11 (m, 1H), 7.21-7.24 (m, 1H).

EXAMPLE 2415-Isoxazol-3-yl-thiophene-2-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide

The title compound was prepared according to the procedure of Example 225 as a yellow/brown solid; ^1H NMR (300 MHz, CDCl_3) δ 2.55 (t, J = 6.12 Hz, 4H), 3.58 (t, J = 6.00 Hz, 4H), 6.46-6.49 (m, 2H), 6.86-6.91 (m, 2H), 7.02-7.09 (m, 2H), 7.12 (s, 1H), 7.36-7.41 (m, 2H); MS (ES) m/z: 403.9 (MH^+).

EXAMPLE 2423,4-Dimethoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide

The title compound was prepared according to the procedure of Example 225 as a dull yellow solid; ^1H NMR (300 MHz, CDCl_3) δ 2.54 (t, J = 4.5 Hz, 4H), 3.55 (t, J = 4.5 Hz, 4H), 3.83 (s, 3H), 3.91 (s, 3H), 6.21 (brs, 1H), 6.83-6.87 (m, 3H), 6.94-7.03 (m, 2H), 7.12 (d, J = 1.5 Hz, 2H); MS (ES) m/z: 391.0 (MH^+); HRMS found for $\text{C}_{18}\text{H}_{17}\text{N}_3\text{O}_4\text{S}_2$: 391.1333.

EXAMPLE 2433,4-Dichloro-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide

To a stirred solution of 0.5 g (1.9 mmol) of the hydrochloride salt of 1-(4-amino-phenyl)-piperidin-4-one (which was obtained in Example 224) in 10 mL of anhydrous methylene chloride was added 0.99 mL (5.7 mmol) of diisopropylethyl amine. After 10 minutes of stirring, 0.51 g (2.1 mmol) of 3,4-dichlorobenzene sulfonyl chloride was added and the mixture was allowed to stir overnight. The reaction mixture was quenched with water and the solvent was removed in vacuo. The residue was dissolved in ethyl acetate and washed twice with water, twice with brine, dried over sodium sulfate and then concentrated in vacuo. The residue was then purified by flash chromatography (10% EtOAc in hexanes to 50% EtOAc in hexanes) and the title compound was collected as 0.25 g of a yellow solid; ^1H NMR (300 MHz, CDCl_3) δ 2.55 (t, J = 6.09 Hz, 4H), 3.58 (t, J = 6.03 Hz, 4H), 6.33 (s, 1H), 6.60-6.88 (m, 2H), 6.95-7.00 (m, 2H), 7.50 (d, J = 1.47 Hz, 2H), 7.78-7.79 (m, 1H); MS (ES) m/z: 398.8 (MH^+); HRMS found for $\text{C}_{17}\text{H}_{16}\text{Cl}_2\text{N}_2\text{O}_3\text{S}$: 398.0227.

EXAMPLE 244N-[4-(4-Oxo-piperidin-1-yl)-phenyl]-4-trifluoromethyl-benzenesulfonamide

The title compound was prepared from 4-(trifluoromethyl)benzene sulfonyl chloride according to the procedure of Example 243 as a yellow solid; ^1H NMR (300 MHz, CDCl_3) δ

2.55 (t, J = 6.12 Hz, 4H), 3.57 (t, J = 6.0 Hz, 4H), 6.41 (s, 1H), 6.81-6.89 (m, 2H), 6.95-7.00 (m, 2H), 7.71 (d, J = 8.37 Hz, 2H), 7.83 (d, J = 8.31 Hz, 2H); MS (ES) m/z: 398.9 (MH⁺); HRMS found for C₁₈H₁₇F₃N₂O₃S: 398.0910.

5 EXAMPLE 245

N-[4-(4-Oxo-piperidin-1-yl)-phenyl]-4-trifluoromethoxy-benzenesulfonamide

The title compound was prepared from 4-(trifluoromethoxy)benzene sulfonyl chloride according to the procedure of Example 243 as a yellow solid; ¹H NMR (300 MHz, CDCl₃) δ 2.54 (t, J = 6.06 Hz, 4H), 3.56 (t, J = 6.03 Hz, 4H), 6.45 (s, 1H), 6.81-6.89 (m, 2H), 6.95-7.00 (m, 2H), 7.24-7.27 (m, 2H), 7.74-7.79 (m, 2H); MS (ES) m/z: 414.9 (MH⁺); HRMS found for C₁₈H₁₇F₃N₂O₄S: 414.0854.

EXAMPLE 246

4-Chloro-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide

The title compound was prepared from 4-chlorobenzene sulfonyl chloride according to the procedure of Example 243 as a yellow solid; ¹H NMR (300 MHz, CDCl₃) δ 2.54 (t, J = 6.09 Hz, 4H), 3.56 (t, J = 6.03 Hz, 4H), 6.51 (s, 1H), 6.80-6.88 (m, 2H), 6.94-7.00 (m, 2H), 7.38-7.43 (m, 2H), 7.61-7.67 (m, 2H); MS (ES) m/z: 364.9 (MH⁺); HRMS found for C₁₇H₁₇ClN₂O₃S: 364.0652.

EXAMPLE 247

4-Butyl-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide

The title compound was prepared from 4-n-butylbenzene sulfonyl chloride according to the procedure of Example 243 as a light grey solid; ¹H NMR (300 MHz, CDCl₃) δ 0.91 (t, J = 7.26 Hz, 3H), 1.23-1.39 (m, 2H), 1.53-1.64 (m, 2H), 2.53 (t, J = 6.12 Hz, 4H), 2.64 (t, J = 7.62 Hz, 2H), 3.55 (t, J = 6.0 Hz, 4H), 6.21 (s, 1H), 6.80-6.85 (m, 2H), 6.94-6.99 (m, 2H), 7.21-7.24 (m, 2H), 7.59-7.62 (m, 2H); HRMS found for C₂₁H₂₆N₂O₃S: 386.1660.

EXAMPLE 248

2,5-Dimethoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide

The title compound was prepared from 2,5-dimethoxybenzene sulfonyl chloride according to the procedure of Example 243 as a yellow solid; ¹H NMR (300 MHz, CDCl₃) δ 2.63 (t, J = 6.15 Hz, 4H), 3.72 (s, 3H), 3.82 (t, J = 6.15 Hz, 4H), 4.03 (s, 3H), 6.77-6.91 (m,

2H), 6.96-7.02 (m, 2H), 7.27-7.32 (m, 2H), 8.13-8.21 (m, 2H); MS (ES) m/z: 391.0 (MH⁺); HRMS found for C₁₉H₂₂N₂O₅S: 390.9799.

EXAMPLE 249

5 3,5-Dichloro-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide

The title compound was prepared from 3,5-dichlorobenzene sulfonyl chloride according to the procedure of Example 243 as a pale yellow solid; ¹H NMR (300 MHz, CDCl₃) δ 2.5 (t, 4H), 3.55 (t, 4H), 6.41 (s, 1H), 6.84-6.91 (m, 2H), 6.96-7.02 (m, 2H), 7.52 (t, J = 1.86 Hz, 1H), 7.56 (d, J = 1.86 Hz, 2H); MS (ES) m/z: 398.8 (MH⁺); HRMS found for C₁₇H₁₆Cl₂N₂O₃S: 398.1622.

EXAMPLE 250

5-Bromo-2-methoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide

The title compound was prepared from 5-bromo-2-methoxybenzene sulfonyl chloride according to the procedure of Example 243 as a yellow solid; ¹H NMR (300 MHz, CDCl₃) δ 2.51 (t, J = 6.03 Hz, 4H), 3.52 (t, J = 6.03 Hz, 4H), 4.06 (s, 3H), 6.77-6.82 (m, 2H), 6.89-7.00 (m, 2H), 7.59 (dd, J = 2.55 Hz, 8.79 Hz, 2H), 7.86 (d, J = 2.49 Hz, 2H); HRMS found for C₁₈H₁₉ Br N₂O₄S: 438.0215.

EXAMPLE 251

{(4-Butyl-benzenesulfonyl)-[4-(4-oxo-piperidin-1-yl)-phenyl]-amino}-acetic acid ethyl ester

A solution of 0.12 g of 4-butyl-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 247), 0.038 mL of ethyl bromoacetate and 0.047 g of potassium carbonate in 10 mL acetonitrile was refluxed overnight. The solvent was removed in vacuo and the residue was purified by flash chromatography (8:1 Hexanes: EtOAc - 1:1 Hexanes: EtOAc) to give 0.107 g of the title compound as a yellow gum; ¹H NMR (300 MHz, CDCl₃) δ 0.93 (t, J = 7.26 Hz, 3H), 1.19-1.26 (m, 3H), 1.31-1.43 (m, 2H), 1.57-1.66 (m, 2H), 2.52 (t, J = 6.03 Hz, 4H), 2.67 (t, J = 7.56 Hz, 2H), 3.60 (t, J = 6.00 Hz, 4H), 4.14 (q, J = 7.14 Hz, 2H), 4.35 (s, 2H), 6.80-6.85 (m, 2H), 7.06-7.12 (m, 2H), 7.24 (m, 2H), 7.59 (d, J = 8.28 Hz, 2H); MS (ES) m/z: 473.0 (MH⁺); HRMS found for C₂₅H₃₂N₂O₅S: 472.2028.

EXAMPLE 252

{(3,4-Dimethoxy-benzenesulfonyl)-[4-(4-oxo-piperidin-1-yl)phenyl]amino}acetic acid ethyl ester

The title compound was prepared from 3,4-dimethoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 242) according to the procedure of Example 251 as a yellow gum; ^1H NMR (300 MHz, CDCl_3) δ 1.26 (t, J = 7.59 Hz, 3H), 2.53 (t, J = 6.09 Hz, 4H), 3.59 (t, J = 6.00 Hz, 4H), 3.83 (s, 3H), 3.94 (s, 3H), 4.11-4.19 (m, 2H), 4.36 (s, 1H), 6.80-6.91 (m, 2H), 7.09-7.14 (m, 2H), 7.17 (d, J = 2.16 Hz, 1H), 7.33 (d, J = 2.16 Hz, 1H), 7.36 (d, J = 2.07 Hz, 1H); MS (ES) m/z: 477.0 (MH^+); HRMS found for $\text{C}_{23}\text{H}_{28}\text{N}_2\text{O}_7\text{S}$: 477.1687.

EXAMPLE 253

{(Butane-1-sulfonyl)-[4-(4-oxo-piperidin-1-yl)-phenyl]-amino}-acetic acid benzyl ester

The title compound was prepared from butane-1-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide (which was obtained in Example 228) and benzyl-2-bromoacetate according to the procedure of Example 251 as an orange oil; ^1H NMR (300 MHz, CDCl_3) δ 0.91 (t, J = 7.29 Hz, 3H), 1.34-1.47 (m, 2H), 1.75-1.86 (m, 2H), 2.55 (t, J = 6.09 Hz, 4H), 3.17-3.23 (m, 2H), 3.62 (t, J = 6.00 Hz, 4H), 4.45 (s, 2H), 5.18 (s, 2H), 6.87-6.92 (m, 2H), 7.30-7.40 (m, 7H); MS (ES) m/z: 459.0 (MH^+); HRMS found for $\text{C}_{24}\text{H}_{30}\text{N}_2\text{O}_5\text{S}$: 459.1944.

EXAMPLE 254

{(3,4-Dimethoxy-benzenesulfonyl)-[4-(4-oxo-piperidin-1-yl)-phenyl]-amino}-acetic acid benzyl ester

The title compound was prepared from 3,4-dimethoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 242) and benzyl-2-bromoacetate according to the procedure of Example 251 as an orange gum; ^1H NMR (300 MHz, CDCl_3) δ 2.53 (t, J = 6.06 Hz, 4H), 3.59 (t, J = 6.00 Hz, 4H), 3.79 (s, 3H), 3.93 (s, 3H), 4.50 (s, 2H), 5.13 (s, 2H), 6.78-6.87 (m, 2H), 7.07-7.10 (m, 2H), 7.15 (d, J = 2.1 Hz, 1H), 7.27-7.37 (m, 7H); MS (ES) m/z: 539.0 (MH^+); HRMS found for $\text{C}_{28}\text{H}_{30}\text{N}_2\text{O}_7\text{S}(\text{MH}^+)$: 539.1842.

EXAMPLE 255

N-{4-[4-(2-Hydroxy-2-phenyl-ethylamino)-piperidin-1-yl]-phenyl}-4-methoxybenzenesulfonamide

A mixture of 4-methoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 218) (0.16g, 0.44 mmol) and 2-amino-1-phenylethanol (0.18 g, 1.3

mmol) in 75 mL of methanol was hydrogenated in the presence of 100 mg of 10% Pd/C under H₂ (5 ~ 20 psi) for overnight. The catalyst was then removed by filtering through a short pad of silica gel. The filtrate was concentrated and purified by silica gel chromatography using 5 - 10% MeOH/CH₂Cl₂ as eluent to give 0.13 g (61%) of the title compound as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.78-1.92 (m, 2 H), 2.50-2.80 (m, 5 H), 3.60-3.70 (m, 2 H), 3.79 (s, 3 H), 4.56-4.60 (m, 1 H), 5.26 (brs, 1 H), 6.76 (d, J = 9.0 Hz, 2 H), 6.86 (d, J = 9.0 Hz, 2 H), 7.04 (d, J = 9.0 Hz, 2 H), 7.20-7.25 (m, 1 H), 7.25-7.36 (m, 4 H), 7.58 (d, J = 9.0 Hz, 2 H); MS (ES) m/z: 482.4 (MH⁺); HRMS Calcd. for C₂₆H₃₁N₃O₄S(M⁺): 481.2035. Found: 481.2028.

EXAMPLE 256

N-(4-[4-[2-Hydroxy-2-(3-hydroxy-phenyl)-ethylamino]-piperidin-1-yl]phenyl)-4-methoxy-benzenesulfonamide

The title compound was prepared from 4-methoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 218) and DL-norphenylephrine according to the procedure of Example 255 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.25-1.60 (m, 2 H), 2.00-2.15 (m, 2 H), 2.50-3.10 (m, 5 H), 3.60-3.70 (m, 2 H), 3.79 (s, 3 H), 4.80-4.90 (m, 1 H), 6.05 (brs, 1 H), 6.70-6.80 (m, 1 H), 6.80-6.85 (m, 4 H), 6.90 (d, J = 9.0 Hz, 2 H), 7.02 (d, J = 9.0 Hz, 2 H), 7.16 (t, J = 7.7 Hz, 1 H), 7.60 (d, J = 9.0 Hz, 2 H), 9.45 (s, 1 H), 9.70 (s, 1 H); MS (ES) m/z: 498.5 (MH⁺); HRMS Calcd. for C₂₆H₃₁N₃O₅S(M⁺): 497.1984. Found: 497.1961.

EXAMPLE 257

N-[4-(4-[4-[2-Hydroxy-2-(3-hydroxy-phenyl)-ethylamino]-piperidin-1-yl]-phenylsulfamoyl)-phenyl]-acetamide

The title compound was prepared from N-[4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl]-acetamide (which was obtained in Example 216) and DL-norphenylephrine according to the procedure of Example 255 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.35-1.50 (m, 2 H), 1.80-2.00 (m, 2 H), 2.06 (s, 3 H), 2.50-2.90 (m, 5 H), 3.45-3.60 (m, 2 H), 4.55-4.65 (m, 1 H), 5.55 (brs, 1 H), 6.60-6.70 (m, 1 H), 6.70-6.85 (m, 4 H), 6.86 (d, J = 9.3 Hz, 2 H), 7.11 (t, J = 7.8 Hz, 1 H), 7.58 (d, J = 8.7 Hz, 2 H), 7.68 (d, J = 8.7 Hz, 2 H), 9.35 (s, 1 H), 10.33 (s, 1 H); MS (ES) m/z: 525.4 (MH⁺); HRMS Calcd. for C₂₇H₃₃N₄O₅S (MH⁺): 525.2172. Found: 525.2177.

EXAMPLE 258

N-(4-{4-[4-((2R)-2-Hydroxy-2-phenyl-ethylamino)-piperidin-1-yl]-phenylsulfamoyl}-phenyl)-acetamide

The title compound was prepared from N-{4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 216) and (1R)-2-amino-1-(3-chloro-phenyl)-ethanol (which was obtained in Example 1) according to the procedure of Example 255 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.55-1.75 (m, 2 H), 2.06 (s, 3 H), 2.00-2.15 (m, 2 H), 2.50-3.20 (m, 5 H), 3.55-3.70 (m, 2 H), 4.90-5.00 (m, 1 H), 6.00-6.20 (brs, 1 H), 6.80 (d, J = 9.0 Hz, 2 H), 6.89 (d, J = 9.0 Hz, 2 H), 7.25-7.52 (m, 5 H), 7.59 (d, J = 8.7 Hz, 2 H), 7.70 (d, J = 8.7 Hz, 2 H), 10.41 (s, 1 H); MS (ES) m/z: 509.2 (MH⁺); HRMS Calcd. for C₂₇H₃₃N₄O₄S (MH⁺): 509.2223. Found: 509.2194.

EXAMPLE 259

N-(4-{[4-(4-{[2-Hydroxy-2-(4-hydroxyphenyl)ethyl]amino}-1-piperidinyl)anilino]sulfonyl}phenyl)-acetamide

The title compound was prepared from N-{4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 216) and DL-octopamine according to the procedure of Example 255 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.55-1.75 (m, 2 H), 2.00-2.15 (m, 2 H), 2.06 (s, 3 H), 2.50-3.20 (m, 5 H), 3.60-3.70 (m, 2 H), 4.80-4.90 (m, 1 H), 6.00 (brs, 1 H), 6.76 (d, J = 9.7 Hz, 2 H), 6.80 (d, J = 9.7 Hz, 2 H), 6.88 (d, J = 9.0 Hz, 2 H), 7.19 (d, J = 8.7 Hz, 2 H), 7.59 (d, J = 9.0 Hz, 2 H), 7.70 (d, J = 8.7 Hz, 2 H), 9.47 (s, 1 H), 10.43 (s, 1 H); MS (ES) m/z: 525.3 (MH⁺); HRMS Calcd. for C₂₇H₃₃N₄O₅S (MH⁺): 525.2172. Found: 525.2178.

EXAMPLE 260

N-[4-(4-{[(2R)-2-(3-Chlorophenyl)-2-hydroxyethyl]amino}-1-piperidinyl)phenyl]-4-methoxybenzenesulfonamide

A mixture of 4-methoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 218) (0.288 g, 0.8 mmol) and (1R)-2-amino-1-(3-chloro-phenyl)-ethanol hydrochloride (which was obtained in Example 1) (0.832 g, 4.0 mmol) was dissolved in 50 mL of methanol and the pH was adjusted to 5 with triethylamine. After stirred at room temperature for one day acetic acid (1 mL) and NaCNBH₃ (50 mg, 0.8 mmol) were then added. The reaction was stirred for another day, the solvent was removed, and the residue was

purified by thin layer chromatography (10% methanol/CH₂Cl₂) to give the title compound as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.60 (m, 2 H), 1.95-2.10 (m, 2 H), 2.50-3.10 (m, 5 H), 3.50-3.70 (m, 2 H), 3.79 (s, 3 H), 4.80-4.90 (m, 1 H), 6.79 (d, J = 9.0 Hz, 2 H), 6.89 (d, J = 9.0 Hz, 2 H), 7.05 (d, J = 9.0 Hz, 2 H), 7.30-7.50 (m, 4 H), 7.60 (d, J = 9.0 Hz, 2 H), 9.60 (brs, 1 H); MS (ES) m/z: 516.2 (MH⁺); HRMS Calcd. for C₂₆H₃₁ClN₃O₄S (MH⁺); 516.1724. Found: 516.1713.

EXAMPLE 261

N-[4-(4-[(2R)-2-Hydroxy-2-phenylethyl]amino}-1-piperidinyl)phenyl]-4-methoxybenzene-sulfonamide

The title compound was prepared from 4-methoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 218) and (1R)-2-amino-1-(3-chlorophenyl)-ethanol hydrochloride (which was obtained in Example 1) according to the procedure of Example 255 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.55-1.75 (m, 2 H), 2.05-2.15 (m, 2 H), 2.50-3.10 (m, 5 H), 3.50-3.70 (m, 2 H), 3.79 (s, 3 H), 4.90-5.05 (m, 1 H), 6.10-6.20 (m, 1 H), 6.79 (d, J = 9.0 Hz, 2 H), 6.89 (d, J = 9.0 Hz, 2 H), 7.05 (d, J = 11.8 Hz, 2 H), 7.25-7.50 (m, 5 H), 7.60 (d, J = 11.8 Hz, 2 H), 9.70 (brs, 1 H); MS (ES) m/z: 482.2 (MH⁺); HRMS Calcd. for C₂₆H₃₂N₃O₄S (MH⁺): 482.2114. Found: 482.2120.

EXAMPLE 262

N-(4-[4-(4-[2-Hydroxy-3-(4-methoxyphenoxy)propyl]amino}-1-piperidinyl)anilino]-sulfonyl)-phenyl)acetamide

The title compound was prepared from N-{4-[4-(4-oxo-piperidin-1-yl)-phenyl]sulfamoyl}-phenyl}-acetamide (which was obtained in Example 216) and 1-amino-3-(4-methoxy-phenoxy)-propan-2-ol according to the procedure of Example 255 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.55-1.75 (m, 2 H), 1.95-2.15 (m, 2 H), 2.06 (s, 3 H), 2.50-3.20 (m, 5 H), 3.85-3.95 (m, 2 H), 4.10-4.20 (m, 1 H), 5.70 (brs, 1 H), 6.80 (d, J = 9.0 Hz, 2 H), 6.80-6.95 (m, 6 H), 7.59 (d, J = 9.0 Hz, 2 H), 7.69 (d, J = 9.0 Hz, 2 H), 10.38 (s, 1 H); MS (ES) m/z: 569.6 (MH⁺); HRMS Calcd. for C₂₉H₃₇N₄O₆S (MH⁺): 569.2434. Found: 569.2418.

EXAMPLE 263

N-(4-{[4-(4-{[(2R)-2-(3,4-Dihydroxyphenyl)-2-hydroxyethyl]amino}-1-piperidinyl)anilino]sulfonyl}-phenyl)acetamide

The title compound was prepared from N-{4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 216) and L-norepinephrine according to the procedure of Example 255 as a grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.50-1.72 (m, 2 H), 1.95-2.10 (m, 2 H), 2.06 (s, 3 H), 2.50-3.20 (m, 5 H), 3.55-3.70 (m, 2 H), 4.05-4.20 (brs, 1 H), 4.60-4.75 (m, 1 H), 5.75-5.90 (brs, 1 H), 6.60-6.90 (m, 7 H), 7.59 (d, J = 9.0 Hz, 2 H), 7.70 (d, J = 9.0 Hz, 2 H), 8.93 (brs, 1 H), 10.42 (s, 1 H); MS (ES) m/z: 541.6 (MH⁺); HRMS Calcd. for C₂₇H₃₃N₄O₆S (MH⁺): 541.2121. Found: 541.2133.

EXAMPLE 264

N-(4-{[2-(4-{[2-Hydroxy-2-(3-hydroxyphenyl)ethyl]amino}-1-piperidinyl)anilino]-sulfonyl}phenyl)-acetamide

The title compound was prepared from N-{4-[2-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 222) and DL-norphenylephrine according to the procedure of Example 255 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.70-1.90 (m, 2 H), 1.90-2.10 (m, 2 H), 2.06 (s, 3 H), 2.50-3.20 (m, 7 H), 4.75-4.95 (m, 1 H), 6.10 (brs, 1 H), 6.50-7.40 (m, 8 H), 7.65-7.80 (m, 4 H), 9.48 (s, 1 H), 10.42 (s, 1 H); MS (ES) m/z: 525.6 (MH⁺); HRMS Calcd. for C₂₇H₃₃N₄O₅S (MH⁺): 525.2172. Found: 525.2164.

EXAMPLE 265

N-(4-{[2-(4-{[(2R)-2-(3,4-Dihydroxyphenyl)-2-hydroxyethyl]amino}-1-piperidinyl)-anilino]-sulfonyl}phenyl)acetamide

The title compound was prepared from N-{4-[2-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 222) and L-norepinephrine according to the procedure of Example 255 as a grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.30-1.52 (m, 2 H), 1.70-1.90 (m, 2 H), 1.89 (s, 3 H), 2.50-3.50 (m, 7 H), 4.40-4.55 (m, 1 H), 6.00 (brs, 1 H), 6.50-6.80 (m, 3 H), 6.95-7.15 (m, 2 H), 7.25-7.40 (m, 2 H), 7.60-7.75 (m, 4 H), 10.30 (s, 1 H); MS (ES) m/z: 541.4 (MH⁺); HRMS Calcd. for C₂₇H₃₃N₄O₆S (MH⁺): 541.2121. Found: 541.2110.

EXAMPLE 266

N-[4-(4-{[(2R)-2-(3,4-Dihydroxyphenyl)-2-hydroxyethyl]amino}-1-piperidinyl)phenyl]-4-methoxy-benzenesulfonamide

The title compound was prepared from 4-methoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 218) and L-norepinephrine according to the procedure of Example 255 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.55 (m, 2 H), 1.90-2.05 (m, 2 H), 2.50-3.00 (m, 5 H), 3.50-3.75 (m, 2 H), 3.79 (s, 3 H), 4.50-4.65 (m, 1 H), 6.60 (d, J = 8.0 Hz, 1 H), 6.68 (d, J = 8.0 Hz, 1 H), 6.76-6.80 (m, 3 H), 6.88 (d, J = 9.0 Hz, 2 H), 7.04 (d, J = 7.8 Hz, 2 H), 7.61 (d, J = 7.8 Hz, 2 H), 8.85 (s, 1 H); MS (ES) m/z: 513.9 (MH⁺); HRMS Calcd. for C₂₆H₃₂N₃O₆S (MH⁺): 514.2011. Found: 514.2000.

EXAMPLE 267

N-(4-{[4-(4-{[2-Hydroxy-2-(4-hydroxy-3-methoxyphenyl)ethyl]amino}-1-piperidinyl)anilino]-sulfonyl}phenyl)acetamide

The title compound was prepared from N-{4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 216) and DL-normetanephrine according to the procedure of Example 255 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.60 (m, 2 H), 1.90-2.06 (m, 2 H), 2.06 (s, 3 H), 2.50-3.50 (m, 5 H), 3.55-3.65 (m, 2 H), 3.77 (s, 3 H), 4.70-4.80 (m, 1 H), 5.70-5.85 (brs, 1 H), 6.70-6.90 (m, 7 H), 7.59 (d, J = 8.7 Hz, 2 H), 7.69 (d, J = 8.7 Hz, 2 H), 8.95 (brs, 1 H), 10.37 (s, 1 H); MS (ES) m/z: 555.2 (MH⁺); HRMS Calcd. for C₂₈H₃₅N₄O₆S (MH⁺): 555.2277. Found: 555.2265.

EXAMPLE 268

N-(4-{[4-(4-{[2-(2,4-Dihydroxyphenyl)-2-hydroxyethyl]amino}-1-piperidinyl)-anilino]sulfonyl}-phenyl)acetamide

The title compound was prepared from N-{4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 216) and 2-amino-1-(2,4-dihydroxyphenyl)-ethanol according to the procedure of Example 255 as a pale yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.55-1.75 (m, 2 H), 1.95-2.15 (m, 2 H), 2.08 (s, 3 H), 2.50-3.20 (m, 5 H), 3.60-3.70 (m, 2 H), 5.04-5.10 (m, 1 H), 6.65-6.75 (m, 1 H), 6.24 (dd, J = 8.1, 2.1 Hz, 1 H), 6.32 (d, J = 2.1 Hz, 1 H), 6.80 (d, J = 9.0 Hz, 2 H), 6.88 (d, J = 9.0 Hz, 2 H), 7.12 (d, J = 8.1 Hz, 1 H), 7.59 (d, J = 9.0 Hz, 2 H), 7.70 (d, J = 9.0 Hz, 2 H), 9.26 (s, 1 H), 9.71 (brs, 1 H), 10.44 (s, 1 H); MS (ES) m/z: 541.4 (MH⁺); HRMS Calcd. for C₂₇H₃₃N₄O₆S (MH⁺): 541.2121. Found: 541.2084.

EXAMPLE 269

N-(4-{[4-(4-{[(2S)-2-Hydroxy-3-(4-hydroxyphenoxy)propyl]amino}-1-piperidinyl)anilino]sulfonyl}-phenyl)acetamide

5 The title compound was prepared from N-{4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 216) and (2S)-1-amino-3-(4-hydroxyphenoxy)-propan-2-ol (which was obtained in Example 5) according to the procedure of Example 255 as a grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.65 (m, 2 H), 1.95-2.15 (m, 2 H), 2.06 (s, 3 H), 2.50-3.20 (m, 5 H), 3.55-3.70 (m, 2 H), 3.80-3.90 (m, 1 H), 4.05-4.20 (m, 1 H), 5.70 (brs, 1 H), 6.67 (d, J = 9.0 Hz, 2 H), 6.76 (d, J = 9.0 Hz, 2 H), 6.78 (d, J = 9.0 Hz, 2 H), 6.88 (d, J = 9.0 Hz, 2 H), 7.58 (d, J = 9.0 Hz, 2 H), 7.69 (d, J = 9.0 Hz, 2 H), 8.97 (s, 1 H), 10.37 (s, 1 H); MS (ES) m/z: 555.1 (MH⁺); HRMS Calcd. for C₂₈H₃₅N₄O₆S (MH⁺): 555.2277. Found: 555.2267.

EXAMPLE 270

N-{4-[4-{4-[(2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)sulfonyl]phenyl}acetamide

15 The title compound was prepared from N-{4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 216) and N-[2-benzyloxy-5-(2-dibenzylamino-1-hydroxy-ethyl)-phenyl]-methanesulfonamide (which was obtained in Example 7) according to the procedure of Example 255 as a yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.35-1.60 (m, 2 H), 1.90-2.10 (m, 2 H), 2.06 (s, 3 H), 2.50-3.00 (m, 5 H), 3.16 (s, 3 H), 3.55-3.70 (m, 2 H), 4.65-4.80 (m, 1 H), 6.00 (brs, 1 H), 6.70-7.25 (m, 7 H), 7.58 (d, J = 9.0 Hz, 2 H), 7.68 (d, J = 9.0 Hz, 2 H), 10.39 (s, 1 H); MS (ES) m/z: 618.1 (MH⁺); HRMS Calcd. for C₂₈H₃₆N₅O₇S₂ (MH⁺): 618.2056. Found: 618.2036.

EXAMPLE 271

4-{[(Hexylamino)carbonyl]amino}-N-[4-(4-{[2-hydroxy-2-(6-methyl-3-pyridinyl)ethyl]amino}-1-piperidinyl)phenyl]benzenesulfonamide

30 The title compound was prepared from 4-(3-hexyl-ureido)-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 225) and 2-amino-1-(6-methylpyridin-3-yl)ethanol according to the procedure of Example 255 as a grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.86 (t, J = 6.8 Hz, 3 H), 1.20-3.30 (m, 19 H), 2.45 (s, 3 H), 3.50-3.75 (m, 2 H), 4.70-4.80 (m, 1 H), 6.41 (t, J = 5.5 Hz, 1 H), 6.78 (d, J = 9.1 Hz, 2 H), 6.87 (d, J = 9.1 Hz,

2 H), 7.21(d, J = 8.0 Hz, 1 H), 7.46(d, J = 9.2 Hz, 2 H), 7.48(d, J = 9.2 Hz, 2 H), 7.64(dd, J = 8.0, 2.0 Hz, 1 H), 8.43(d, J = 2.0 Hz, 1 H), 9.00 (s, 1 H), 9.50 (brs, 1 H), 11.10 (s, 1 H); MS (ES) m/z: 609.3 (MH⁺); HRMS Calcd. for C₃₂H₄₅N₆O₄S (MH⁺): 609.3223. Found: 609.3235.

5 EXAMPLE 272

N-(4-{[4-(4-{[(2S)-2-Hydroxy-3-phenoxypropyl]amino}-1-piperidiny]anilino]-sulfonyl}phenyl)-acetamide

The title compound was prepared from N-{4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 216) and (2S)-1-amino-3-phenoxy-propan-2-ol (which was obtained in Example 3) according to the procedure of Example 255 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.65 (m, 2 H), 1.95-2.10 (m, 2 H), 2.06 (s, 3 H), 2.50-3.20 (m, 5 H), 3.55-3.75 (m, 2 H), 3.96 (d, J = 5.2 Hz, 2 H), 4.15-4.25 (m, 1 H), 5.70 (brs, 1 H), 6.80 (d, J = 9.0 Hz, 2 H), 6.88 (d, J = 9.0 Hz, 2 H), 6.90-7.00 (m, 3 H), 7.25-7.35 (m, 2 H), 7.59 (d, J = 9.0 Hz, 2 H), 7.69 (d, J = 9.0 Hz, 2 H), 9.70 (s, 1 H), 10.37 (s, 1 H); MS (ES) m/z: 539.1 (MH⁺); HRMS Calcd. for C₂₈H₃₅N₄O₅S (MH⁺): 539.2328. Found: 539.2357.

EXAMPLE 273

5-[2-({1-[4-({[4-(Acetylamino)phenyl]sulfonyl}amino)phenyl]-4-piperidiny]amino)-1-hydroxy-ethyl]-1H-indole-7-carboxamide

The title compound was prepared from N-{4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 216) and 5-(2-amino-1-hydroxy-ethyl)-1H-indole-7-carboxamide according to the procedure of Example 255 as a pale grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.60-1.80 (m, 2 H), 2.00-2.15 (m, 2 H), 2.06 (s, 3 H), 2.50-2.70 (m, 2 H), 3.10-3.20 (m, 3 H), 3.60-3.75 (m, 2 H), 4.95-5.05 (m, 1 H), 6.13 (brs, 1 H), 6.49 (t, J = 2.7 Hz, 1 H), 6.81 (d, J = 9.0 Hz, 2 H), 6.88 (d, J = 9.0 Hz, 2 H), 7.35 (t, J = 2.7 Hz, 1 H), 7.42 (brs, 1 H), 7.59 (d, J = 9.0 Hz, 2 H), 7.69 (d, J = 9.0 Hz, 2 H), 7.77 (s, 1 H), 8.11 (s, 1 H), 9.72 (s, 1 H), 10.40 (s, 1 H); MS (ES) m/z: 591.1 (MH⁺); HRMS Calcd. for C₃₀H₃₅N₆O₅S (MH⁺): 591.2390. Found: 591.2392.

30 EXAMPLE 274

N-[4-({4-[4-({(2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl}amino)-1-piperidiny]anilino}sulfonyl}phenyl]acetamide

The title compound was prepared from N-{4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 216) and (S)-4-[2-hydroxy-3-

aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) according to the procedure of Example 255 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.60-1.80 (m, 2 H), 2.00-2.15 (m, 2 H), 2.06 (s, 3 H), 2.50-2.70 (m, 2 H), 2.90-3.20 (m, 3 H), 3.60-3.75 (m, 2 H), 4.15-4.25 (m, 1 H), 5.70 (brs, 1 H), 6.61 (t, J = 8.7 Hz, 1 H), 6.80-6.92 (m, 5 H), 7.60 (d, J = 9.0 Hz, 2 H), 7.70 (d, J = 9.0 Hz, 2 H), 9.72 (brs, 1 H), 10.42 (s, 1 H), 10.65 (s, 1 H), 10.80 (s, 1); MS (ES) m/z: 595.2 (MH⁺); HRMS Calcd. for C₂₉H₃₅N₆O₆S (MH⁺): 595.2339. Found: 595.2332.

EXAMPLE 275

4-[(Hexylamino)carbonylamino]-N-[4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]phenyl]benzenesulfonamide

The title compound was prepared from 4-(3-hexyl-ureido)-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 225) and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) according to the procedure of Example 255 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.86 (t, J = 6.8 Hz, 3 H), 1.20-1.60 (m, 10 H), 1.90-2.05 (m, 2 H), 2.50-3.50 (m, 9 H), 3.50-3.65 (m, 1 H), 3.95-4.05 (m, 2 H), 6.43 (t, J = 5.6 Hz, 1 H), 6.58 (d, J = 7.8 Hz, 1 H), 6.61 (d, J = 8.2 Hz, 1 H), 6.70-6.89 (m, 5 H), 7.46(d, J = 9.0 Hz, 2 H), 7.51(d, J = 9.0 Hz, 2 H), 9.06 (s, 1 H), 9.60 (brs, 1 H), 10.60 (s, 1 H), 10.75 (s, 1 H); MS (ES) m/z: 680.3 (MH⁺); HRMS Calcd. for C₃₄H₄₆N₇O₆S (MH⁺): 680.3230. Found: 680.3221.

EXAMPLE 276

4-[(Hexylamino)carbonylamino]-N-[4-[4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl]phenyl] benzenesulfonamide

The title compound was prepared from 4-(3-hexyl-ureido)-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 225) and N-[2-benzyloxy-5-(2-amino-(1R)-1-hydroxy-ethyl)-phenyl]-methanesulfonamide (which was obtained in Example 8) according to the procedure of Example 255 as a grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.86 (t, J = 6.9 Hz, 3 H), 1.20-1.80 (m, 10 H), 1.95-2.15 (m, 2 H), 2.50-3.30 (m, 7 H), 2.97 (s, 3 H), 3.55-3.70 (m, 2 H), 4.70-4.85 (m, 1 H), 5.90-6.10 (m, 1 H), 6.48 (t, J = 5.6 Hz, 1 H), 6.83 (d, J = 9.2 Hz, 2 H), 6.90 (d, J = 9.2 Hz, 2 H), 6.91(d, J = 8.4 Hz, 1 H), 7.07(dd, J = 8.4, 2.0 Hz, 1 H), 7.24 (d, J = 2.0 Hz, 1 H), 7.46(d, J = 9.2 Hz, 2 H), 7.51(d, J = 9.2 Hz, 1 H), 8.50-8.90

(brs, 1 H), 9.39 (s, 1 H), 9.61 (s, 1 H); MS (ES) m/z: 703.4 (MH⁺); HRMS Calcd. for C₃₃H₄₇N₆O₇S₂ (MH⁺): 703.2948. Found: 703.2946.

EXAMPLE 277

5 4-[4-(3-Cyclopentylpropyl)-5-oxo-4,5-dihydro-1H-tetraazol-1-yl]-N-[4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl]benzene-sulfonamide

The title compound was prepared from 4-[4-(3-cyclopentyl-propyl)-5-oxo-4,5-dihydro-tetrazol-1-yl]-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in
10 Example 226) and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) according to the procedure of Example 255 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.90-4.00 (m, 29 H), 5.10-5.30 (m, 1 H), 6.58 (d, J = 7.9 Hz, 1 H), 6.61 (d, J = 7.9 Hz, 1 H), 6.81 (d, J = 8.9 Hz, 2 H), 6.89 (d, J = 8.9 Hz, 2 H), 6.90 (dd, J = 7.9, 7.9 Hz, 1 H), 7.86 (d, J = 8.5 Hz, 2 H), 8.07 (d, J = 8.5 Hz, 2 H), 10.70 (s, 1 H), 10.80 (s, 1 H); MS (ES)
15 m/z: 732.3 (MH⁺); HRMS Calcd. for C₃₆H₄₆N₉O₆S (MH⁺): 732.3292. Found: 732.3294.

EXAMPLE 278

N-[4-[4-((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino)-1-piperidinyl]phenyl]-5-(2-pyridinyl)-2-thiophenesulfonamide

20 5-Pyridin-2-yl-thiophene-2-sulfonic acid [4-(4-oxo-piperidin-1-yl)- phenyl]-amide (which was obtained in Example 227) (0.21g, 0.5 mmol) and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) (0.11g, 0.5 mmol) were mixed in dimethylformamide (10 mL) and then treated with sodium triacetoxyborohydride (0.16g, 0.75 mmol) and acetic acid (0.045g, 0.75 mmol). After stirring at room temperature under a nitrogen
25 atmosphere for one day the mixture was quenched with 1N NaOH and then poured into a saturated aqueous NaHCO₃. The precipitate which formed was collected and purified by preparative thin layer chromatography (16% MeOH/CH₂CH₂) to give the titled compound as a pale yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.25-1.40 (m, 2 H), 1.80-1.90 (m, 2 H), 2.50-2.90 (m, 5 H), 3.53 (brd, J = 9.0 Hz, 2 H), 3.85-4.00 (m, 2 H), 4.00-4.10 (m, 1 H), 4.91
30 (brs, 1 H), 6.56 (d, J = 5.7 Hz, 1 H), 6.61 (d, J = 5.7 Hz, 1 H), 6.80-6.90 (m, 3 H), 6.96 (d, J = 6.6 Hz, 2 H), 7.36 (dd, J = 3.3, 1.2 Hz, 1 H), 7.41 (d, J = 3.0 Hz, 1 H), 7.75 (d, J = 3.0 Hz, 1 H), 7.88 (dd, J = 6.0, 1.2 Hz, 1 H), 7.98 (d, J = 6.0 Hz, 1 H), 8.54 (d, J = 3.3 Hz, 1 H), 10.60 (s, 1 H). Found: 621.1954. Found: 621.1952.

EXAMPLE 279

N-[4-(4-[(2S)-2-Hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-piperidinyl]phenyl]-3,4-dimethoxybenzenesulfonamide

The title compound was prepared according to the procedure of Example 278 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.25 (m, 2H), 1.75 (m, 2H), 2.27 (m, 2H), 2.52-2.61 (m, 2H), 2.65 (m, 1H), 2.73 (m, 1H), 3.15-3.17 (m, 2H), 3.54-3.58 (m, 2H), 3.72 (s, 3H), 3.78 (s, 3H), 3.81-3.83 (m, 1H), 3.86-3.89 (m, 2H), 6.54-6.69 (m, 1H), 6.72-6.81 (m, 6H), 6.89 (d, 1H, J = 9.0 Hz), 7.03 (d, 2H, J = 8.52 Hz), 7.16 (d, 1H, J = 2.07 Hz), 7.20-7.24 (dd, 1H, J = 2.04 Hz, 8.37 Hz), 8.92 (s, 1H), 9.61 (brs, 1H); MS (ES) m/z: 558.0 (MH⁺); HRMS found for C₃₄H₃₈N₄O₆S: 558.2271.

EXAMPLE 280

N-(4-{4-[2-Hydroxy-2-{4-hydroxy-3-[(methanesulfonyl)amino]phenyl}ethyl]amino}-1-piperidinyl]phenyl)-3,4-dimethoxybenzenesulfonamide

The title compound was prepared according to the procedure of Example 278 as a brown solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.50-1.59 (m, 2H), 1.95-2.05 (m, 2H), 2.54-2.62 (m, 2H), 2.72 (m, 2H), 2.94 (s, 3H), 3.00-3.04 (m, 2H), 3.56 (brd, 2H, J = 12.00 Hz), 3.72 (s, 3H), 3.78 (s, 3H), 4.10 (brs, 1H), 4.70 (brd, 1H, J = 7.8 Hz), 5.95 (brs, 1H), 6.81 (d, 1H, J = 9.09 Hz), 6.86-6.92 (m, 2H), 7.01-7.04 (m, 2H), 7.17-7.24 (m, 5H), 8.45 (brs, 1H), 9.16 (s, 1H); MS (ES) m/z: 621.0 (MH⁺); HRMS found for C₂₈H₃₆N₄O₈S₂: 621.2079.

EXAMPLE 281

4-Butoxy-N-(4-{4-[2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-phenyl)-benzenesulfonamide

The title compound was prepared according to the procedure of Example 278 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.915 (t, J = 7.32 Hz, 3H), 1.07-1.14 (m, 2H), 1.34-1.47 (m, 2H), 1.63-1.73 (m, 2H), 1.91 (m, 3H), 2.27 (m, 2H), 2.55-2.63 (m, 2H), 2.73 (m, 2H), 2.8 (m, 2H), 2.93 (s, 3H), 3.16 (m, 2H), 3.53-3.58 (m, 2H), 3.99 (t, J = 6.39 Hz, 2H), 4.58 (brs, 1H), 6.78 (d, J = 9.09 Hz, 2H), 6.83-6.89 (m, 3H), 7.00-7.05 (m, 3H), 7.20 (s, 2H), 7.57 (d, J = 8.82 Hz, 2H), 9.64 (brs, 1H); MS (ES) m/z: 633.1 (MH⁺); HRMS found for C₃₀H₄₀N₄O₇S₂: 633.2401.

EXAMPLE 282

N-(4-{[4-(4-{[(2S)-3-(9H-Carbazol-4-yloxy)-2-hydroxypropyl]amino}-1-piperidiny)]-anilino]-sulfonyl}phenyl)acetamide

The title compound was prepared from N-{4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 216) and (2S)-3-(9H-carbazol-4-yloxy)-2-hydroxy-propylamine (Berridge et al., *Int. J. Radial. Appl. Instrum.*, **1992**, 563) according to the procedure of Example 255 as a yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.55-1.75 (m, 2 H), 2.00-2.15 (m, 2 H), 2.06 (s, 3 H), 2.50-2.70 (m, 2 H), 3.00-3.50 (m, 3 H), 3.60-3.70 (m, 2 H), 4.10-4.25 (m, 2 H), 4.35-4.50 (m, 1 H), 5.97 (brs, 1 H), 6.72 (d, J = 8.0 Hz, 1 H), 6.80 (d, J = 8.0 Hz, 2 H), 6.88 (d, J = 8.0 Hz, 2 H), 7.10-7.50 (m, 5 H), 7.59 (d, J = 8.7 Hz, 2 H), 7.69 (d, J = 8.7 Hz, 2 H), 8.22 (d, J = 7.8 Hz, 1 H), 9.71 (s, 1 H), 10.40 (s, 1 H), 11.32 (s, 1 H); MS (ES) m/z: 627.9 (MH⁺); HRMS Calcd. for C₃₄H₃₈N₅O₅S (MH⁺): 628.2594. Found: 628.2593.

EXAMPLE 283

5-Chloro-N-{4-[4-({(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl})-amino]-1-piperidiny]phenyl}-3-methyl-1-benzothiophene-2-sulfonamide

The title compound was prepared according to the procedure of Example 278 as a yellow solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.33-1.36 (m, 2H), 1.79-1.91 (m, 2H), 2.21-2.27 (m, 2H), 2.40 (s, 3H), 2.58-2.66 (m, 2H), 2.73 (m, 2H), 2.84-2.88 (m, 2H), 3.46-3.56 (m, 2H), 3.92-4.03 (m, 2H), 5.03 (brs, 1H), 6.55-6.63 (m, 2H), 6.81 (t, J = 9.3 Hz, 3H), 6.86-7.00 (m, 2H), 7.55 (dd, J = 1.8 Hz, 8.7 Hz, 1H), 7.98 (d, J = 1.8 Hz, 1H), 8.04 (d, J = 8.7 Hz, 1H), 10.54 (s, 1H), 10.7 (s, 1H); MS (ES) m/z: 642.0 (MH⁺); HRMS found for C₃₀H₃₂ClN₅O₅S₂: 642.1598.

EXAMPLE 284

4-Cyano-N-{4-[4-({(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl})-amino]-1-piperidiny]phenyl}benzenesulfonamide:

The title compound was prepared according to the procedure of Example 278 as a yellow solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.27-1.37 (m, 2H), 1.85-1.90 (m, 2H), 2.56-2.75 (m, 2H), 2.79-2.80 (m, 2H), 2.82-2.84 (m, 2H), 3.50-3.51 (m, 2H), 3.87-3.96 (m, 2H), 3.99-4.03 (m, 2H), 4.90 (brs, 1H), 6.56-6.63 (m, 2H), 6.67-6.87 (m, 5H), 7.81 (d, 2H), 8.02 (d, 2H), 10.58 (s, 1H), 10.92 (brs, 1H); MS (ES) m/z: 563.0 (MH⁺); HRMS found for C₃₀H₃₂N₅O₅S₂: 563.2090.

EXAMPLE 285

4-Cyano-N-[(4-cyanophenyl)sulfonyl]-N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl} benzenesulfonamide

5 The title compound was prepared according to the procedure of Example 278 as a pale yellow solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.23-1.34 (m, 2H), 1.90 (m, 2H), 2.26-2.28 (m, 2H), 2.63-2.75 (m, 2H), 2.79-2.87 (m, 2H), 3.72-3.76 (m, 2H), 3.89-3.97 (m, 2H), 4.01-4.05 (m, 2H), 4.92 (brs, 1H), 6.57 (d, J = 7.59 Hz, 1H), 6.62 (d, J = 8.19 Hz, 1H), 6.79-6.84 (m, 4H), 6.87-6.92 (m, 4H), 7.99 (d, 2H), 8.21 (d, 2H), 10.55 (s, 1H), 10.7 (brs, 1H); MS (ES) m/z: 728.0 (MH⁺); HRMS found for C₃₀H₃₂N₅O₅S₂: 728.1970.

10

EXAMPLE 286

3-Bromo-5-chloro-N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}-2-thiophenesulfonamide

15 The title compound was prepared according to the procedure of Example 278 as an orange-yellow solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.35-1.44 (m, 2H), 1.84-2.05 (m, 2H), 2.60-2.67 (m, 2H), 2.72-2.77 (m, 2H), 2.92-2.96 (m, 2H), 3.15-3.17 (m, 2H), 3.55-3.59 (m, 2H), 3.95-4.02 (m, 2H), 5.12 (brs, 1H), 6.56-6.64 (m, 1H), 6.82 (m, 1H), 6.88 (s, 2H), 6.92 (d, J = 8.97 Hz, 4H), 7.38 (s, 1H), 10.6 (s, 1H), 10.7 (s, 1H); MS (ES) m/z: 657.8 (MH⁺); HRMS found for C₂₅H₂₇BrClN₅O₅S₂: 656.0444.

20

EXAMPLE 287

N-{4-[4-((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino)-1-piperidinyl]phenyl}-5-(3-isoxazolyl)-2-thiophenesulfonamide

25 The title compound was prepared according to the procedure of Example 278 as a red-brown solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.36-1.40 (m, 2H), 1.90 (m, 2H), 2.27 (m, 1H), 2.61-2.69 (m, 2H), 2.72-2.76 (m, 2H), 2.87-2.91 (m, 2H), 3.55-3.60 (m, 2H), 3.93-4.02 (m, 2H), 5.07 (brs, 1H), 6.59 (q, 2H), 6.81-6.89 (m, 4H), 6.94 (d, J = 9.03 Hz, 2H), 7.06 (d, J = 1.92 Hz, 1H), 7.47 (d, J = 4.02 Hz, 1H), 7.66 (d, J = 3.93 Hz, 1H), 8.71 (d, J = 1.98 Hz, 1H), 10.55 (s, 1H), 10.7 (brs, 1H); MS (ES) m/z: 611.0 (MH⁺).

30

EXAMPLE 288

4-[4-(3-Cyclopentyl-propyl)-5-oxo-4,5-dihydro-tetrazol-1-yl]-N-(4-{4-[2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethaylamino]-piperidin-1-yl}-phenyl)-benzenesulfonamide

The title compound was prepared from 4-[4-(cyclopentyl-propyl)-5-oxo-4,5-dihydro-tetrazol-1-yl]-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 226) and N-[2-benzyloxy-5-(2-dibenzylamino-1-hydroxy-ethyl)-phenyl]-methanesulfonamide (which was obtained in Example 7) according to the procedure of Example 255 as a grey solid; MS (ES) m/z: 754.9 (MH⁺); HRMS Calcd. for C₃₅H₄₇N₈O₇S₂(MH⁺): 755.3009. Found: 755.2997.

EXAMPLE 289

4-Butoxy-N-(4-{4-[3-(9H-carbazol-4-yloxy)-2-hydroxy-propylamino]-piperidin-1-yl}-phenyl)-benzenesulfonamide

The title compound was prepared according to the procedure of Example 278 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.91 (t, J = 7.32 Hz, 3H), 1.34-1.46 (m, 2H), 1.62-1.72 (m, 2H), 1.90 (m, 2H), 2.57-2.65 (m, 2H), 2.83-2.85 (m, 2H), 2.96-2.99 (m, 2H), 3.17 (d, J = 5.13 Hz, 2H), 3.49-3.54 (m, 2H), 3.99 (t, J = 6.45 Hz, 2H), 4.11-4.16 (m, 2H), 5.25 (brs, 1H), 5.76 (s, 1H), 6.68 (d, J = 7.8 Hz, 1H), 6.76 (d, J = 9.3 Hz, 2H), 6.87 (d, J = 9.0 Hz, 2H), 7.00-7.15 (m, 4H), 7.25-7.36 (m, 2H), 7.44 (d, J = 8.1 Hz, 1H), 7.57 (d, J = 8.7 Hz, 2H), 8.20 (d, J = 7.8 Hz, 1H), 9.63 (brs, 1H), 11.25 (s, 1H); MS (ES) m/z: 643.2 (MH⁺); HRMS found for C₃₆H₄₂N₄O₅S: 643.2961.

EXAMPLE 290

N-[4-(4-{4-[(2S)-3-(9H-Carbazol-4-yloxy)-2-hydroxy-propylamino]-piperidin-1-yl}-phenyl)-4-(3-hexyl-ureido)-benzenesulfonamide

The title compound was prepared from 4-(3-hexyl-ureido)-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 225) and (2S)-3-(9H-carbazol-4-yloxy)-2-hydroxy-propylamine (Berridge et al., *Int. J. Radial. Appl. Instrum.*, **1992**, 563) according to the procedure of Example 255 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.86 (t, J = 6.8 Hz, 3 H), 1.20-1.45 (m, 8 H), 1.40-1.55 (m, 2 H), 1.90-2.05 (m, 2 H), 2.50-2.75 (m, 2 H), 2.90-3.50 (m, 7 H), 3.60-3.70 (m, 2 H), 4.10-4.35 (m, 3 H), 6.40 (t, J = 5.6 Hz, 1 H), 6.68 (d, J = 8.0 Hz, 1 H), 6.78 (d, J = 9.0 Hz, 2 H), 6.88 (d, J = 9.0 Hz, 2 H), 7.08 (d, J = 8.0 Hz, 1 H), 7.14 (t, J = 7.2 Hz, 1 H), 7.21 (d, J = 8.0 Hz, 1 H), 7.33 (t, J = 5.2 Hz, 1 H), 7.40-7.60

(m, 5 H), 8.21 (d, J = 7.7 Hz, 1 H), 9.01 (s, 1 H), 9.59 (brs, 1 H), 11.30 (s, 1 H); MS (ES) m/z: 713.1 (MH⁺); HRMS Calcd. for C₃₉H₄₉N₆O₅S (MH⁺): 713.3485. Found: 713.3501.

EXAMPLE 291

5 N-{4-[4-[4-[(2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]-phenyl}ethyl)amino]-1-piperidinyl]anilino)sulfonylphenyl}acetamide

The title compound was prepared from N-{4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 216) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-benzyloxy-phenyl]-methanesulfonamide (which was obtained in Example 8) according
10 to the procedure of Example 255 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.70 (m, 2 H), 1.90-2.10 (m, 2 H), 2.06 (s, 3 H), 2.50-2.65 (m, 2 H), 2.90-3.15 (m, 3 H), 2.94 (s, 3 H), 3.55-3.70 (m, 2 H), 4.65-4.80 (m, 1 H), 6.79 (d, J = 9.0 Hz, 2 H), 6.97 (d, J = 9.0 Hz, 2 H), 7.00 (d, J = 8.0 Hz, 1 H), 7.06 (dd, J = 8.0, 1.2 Hz, 1 H), 7.22 (d, J = 1.2 Hz, 1 H), 7.40 (d, J = 8.7 Hz, 2 H), 7.69 (d, J = 8.7 Hz, 2 H), 10.42 (s, 1 H), 10.44 (s, 1 H); MS (ES) m/z: 618.0
15 (MH⁺); HRMS Calcd. for C₂₈H₃₆N₅O₇S₂ (MH⁺): 618.2056. Found: 618.2056.

EXAMPLE 292

N-[4-(4-{[(2S)-3-(9H-Carbazol-4-yloxy)-2-hydroxypropyl]amino}-1-piperidinyl) phenyl]-3,4-dimethoxybenzenesulfonamide

20 The title compound was prepared according to the procedure of Example 278 as a tan solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.38 (m, 2H), 1.90 (m, 2H), 2.59-2.65 (m, 2H), 2.84 (m, 2H), 2.97 (m, 2H), 3.50-3.54 (m, 2H), 3.71 (s, 3H), 3.78 (s, 3H), 4.10-4.14 (m, 2H), 4.16-4.17 (m, 2H), 5.2 (brs, 1H), 6.68 (d, J = 6.0 Hz, 1H), 6.77 (d, J = 6.9 Hz, 2H), 6.88 (d, J = 6.9 Hz, 2H), 7.01-7.07 (q, 2H), 7.10-7.17 (m, 2H), 7.21-7.23 (dd, J = 1.8 Hz, 6.3 Hz, 1H), 7.26-7.35 (m,
25 2H), 7.44 (d, J = 6.0 Hz, 1H), 8.20 (d, J = 5.7 Hz, 1H), 11.2 (s, 1H); MS (ES) m/z: 631.2 (MH⁺); HRMS found for C₃₄H₃₈N₄O₆S: 631.2596.

EXAMPLE 293

30 N-[4-(4-{[(2S)-2-Hydroxy-3-(4-hydroxyphenoxy)propyl]amino}-1-piperidinyl)phenyl]-5-(2-pyridinyl)-2-thiophenesulfonamide

The title compound was prepared from 5-pyridin-2-yl-thiophene-2-sulfonic acid [4-(4-oxo-piperidin-1-yl)- phenyl]-amide(which was obtained in Example 227) and 4-((2S)-3-amino-2-hydroxy-propoxy)-phenol (which was obtained in Example 5) according to the procedure of Example 278 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.80-

1.90 (m, 2 H), 2.40-2.80 (m, 5 H), 3.50-3.60 (m, 2 H), 3.70-3.90 (m, 3 H), 4.99 (brs, 1 H), 6.66 (d, J = 8.0 Hz, 2 H), 6.75 (d, J = 8.0 Hz, 2 H), 6.83 (d, J = 9.0 Hz, 2 H), 6.96 (d, J = 9.0 Hz, 1 H), 7.36 (dd, J = 4.4, 1.7 Hz, 1 H), 7.41 (d, J = 4.0 Hz, 1 H), 7.76 (d, J = 4.0 Hz, 1 H), 7.88 (dd, J = 8.0, 1.7 Hz, 1 H), 8.00 (d, J = 8.0 Hz, 1 H), 8.54 (d, J = 4.4 Hz, 1 H), 8.89 (s, 1 H); MS

5 (ES) m/z: 580.9 (MH⁺); HRMS Calcd. for C₂₉H₃₃N₄O₅S₂ (MH⁺): 581.1892. Found: 581.1910.

EXAMPLE 294

N-(4-{4-[(2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}-phenyl)-5-(2-pyridinyl)-2-thiophenesulfonamide

10 The title compound was prepared from 5-pyridin-2-yl-thiophene-2-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide (which was obtained in Example 227) and N-[5-(2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 9) according to the procedure of Example 278 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.80-1.90 (m, 2 H), 2.45-2.75 (m, 5 H), 2.91 (s, 3 H), 3.40-3.60 (m, 2 H), 4.47 (dd, J = 8.0, 4.1 Hz, 1 H), 6.80 (d, J = 8.3 Hz, 1 H), 6.82 (d, J = 8.0 Hz, 2 H), 6.95 (d, J = 8.0 Hz, 2 H), 7.00 (dd, J = 8.3, 2.0 Hz, 1 H), 7.17 (d, J = 2.0 Hz, 1 H), 7.37 (dd, J = 4.8, 1.7 Hz, 1 H), 7.40 (d, J = 3.9 Hz, 1 H), 7.75 (d, J = 3.9 Hz, 1 H), 7.88 (dd, J = 8.0, 1.7 Hz, 1 H), 7.98 (d, J = 8.0 Hz, 1 H), 8.54 (brd, J = 4.8 Hz, 1 H); MS (ES) m/z: 644.1 (MH⁺); HRMS Calcd. for C₂₉H₃₄N₅O₆S₃ (MH⁺): 644.1671. Found: 644.1663.

20

EXAMPLE 295

N-(4-{4-[(2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl)-1-butanesulfonamide

25 The title compound was prepared from butane-1-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide (which was obtained in Example 228) and N-[2-benzyloxy-5-(2-dibenzylamino-1-hydroxy-ethyl)-phenyl]-methanesulfonamide (which was obtained in Example 7) according to the procedure of Example 255 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.83 (t, J = 7.2 Hz, 3 H), 1.20-1.40 (m, 2 H), 1.50-1.70 (m, 4 H), 1.95-2.10 (m, 2 H), 2.40-2.60 (m, 2 H), 2.94 (s, 3 H), 2.90-3.20 (m, 5 H), 3.62-3.75 (m, 2 H), 4.70-4.80 (m, 1 H), 5.95 (brs, 1 H), 6.85-6.95 (m, 3 H), 7.00-7.10 (m, 3 H), 7.24 (d, J = 2.0 Hz, 1 H), 8.70 (brs, 1 H), 9.33 (brs, 1 H); MS (ES) m/z: 541.0 (MH⁺); HRMS Calcd. for C₂₄H₃₇N₄O₆S₂ (MH⁺): 541.2155. Found: 541.2161.

30

EXAMPLE 296

N-{4-[4-((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}-1-butanesulfonamide

The title compound was prepared from butane-1-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide (which was obtained in Example 228) and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) according to the procedure of Example 255 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.83(t, J = 7.2 Hz, 3 H), 1.20-1.70 (m, 6 H), 1.95-2.10 (m, 2 H), 2.67 (brt, J = 11.7 Hz, 2 H), 2.70-3.20 (m, 7 H), 3.62-3.75 (m, 2 H), 3.95-4.10 (m, 3 H), 6.59 (d, J = 7.5 Hz, 1 H), 6.63 (d, J = 8.0 Hz, 1 H), 6.80-7.00 (m, 3 H), 7.06 (d, J = 9.0 Hz, 2 H), 9.32 (brs, 1 H), 10.61 (brs, 1 H), 10.73 (brs, 1 H); MS (ES) m/z: 518.1 (MH⁺); HRMS Calcd. for C₂₅H₃₆N₅O₅S (MH⁺): 518.2437. Found: 518.2452.

EXAMPLE 297

N-(4-{4-[2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl)-1-octanesulfonamide

The title compound was prepared from octane-1-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide (which was obtained in Example 230) and N-[2-benzyloxy-5-(2-dibenzylamino-1-hydroxy-ethyl)-phenyl]-methanesulfonamide (which was obtained in Example 7) according to the procedure of Example 255 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.84(t, J = 7.0 Hz, 3 H), 1.15-1.40 (m, 12 H), 1.50-1.70 (m, 2 H), 1.80-1.95 (m, 2 H), 2.50-2.92 (m, 7 H), 3.50-3.65 (m, 2 H), 4.49 (dd, J = 8.0, 4.1 Hz, 1 H), 6.82 (d, J = 8.3 Hz, 1 H), 6.88 (d, J = 8.0 Hz, 2 H), 7.00 (dd, J = 8.3, 2.0 Hz, 1 H), 7.04 (d, J = 8.0 Hz, 2 H), 7.17 (d, J = 2.0 Hz, 1 H); MS (ES) m/z: 597.1 (MH⁺); HRMS Calcd. for C₂₈H₄₅N₄O₆S₂ (MH⁺): 597.2781. Found: 597.2776.

EXAMPLE 298

N-{4-[4-((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}-1-octanesulfonamide

The title compound was prepared from octane-1-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide (which was obtained in Example 230) and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) according to the procedure of Example 255 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.85(t, J = 7.0 Hz, 3 H), 1.10-1.40 (m, 10 H), 1.50-1.70 (m, 4 H), 1.95-2.16 (m, 2 H), 2.67 (brt, J = 11.1 Hz, 2 H), 2.93

(brt, J = 7.9 Hz, 2 H), 2.95-3.20 (m, 3 H), 3.62-3.75 (m, 2 H), 4.00-4.12 (m, 2 H), 4.12-4.30 (m, 1 H), 6.59 (d, J = 7.8 Hz, 1 H), 6.63 (d, J = 8.3 Hz, 1 H), 6.80-7.00 (m, 3 H), 7.07 (d, J = 9.0 Hz, 2 H), 9.33 (brs, 1 H), 10.60 (brs, 1 H), 10.75 (brs, 1 H); MS (ES) m/z: 574.1 (MH⁺); HRMS Calcd. for C₂₉H₄₄N₅O₅S (MH⁺): 574.3063. Found: 574.3084.

5

EXAMPLE 299

N-{4-[4-((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl-amino)-1-piperidinyl]phenyl}-5-[[5-(trifluoromethyl)-2-pyridinyl]sulfonyl]-2-thiophenesulfonamide

The title compound was prepared from 5-(5-trifluoromethyl-pyridine-2-sulfonyl)-thiophene-2-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide (which was obtained in
10 Example 229) and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) according to the procedure of Example 278 as a yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.30-1.50 (m, 2 H), 1.80-2.00 (m, 2 H), 2.50-3.00 (m, 5 H), 3.54 (brd, J = 9.3 Hz, 2 H), 3.90-4.10 (m, 3 H), 6.57 (d, J = 6.0 Hz, 1 H), 6.62 (d, J = 6.0 Hz, 1 H), 6.62-
15 6.90 (m, 5 H), 7.92 (d, J = 2.0 Hz, 1 H), 8.39 (d, J = 9.0 Hz, 1 H), 8.48 (d, J = 2.0 Hz, 1 H), 8.62 (dd, J = 9.0, 2.0 Hz, 1 H), 9.23 (s, 1 H), 10.56 (s, 1 H), 10.69 (s, 1 H); MS (ES) m/z: 752.9 (MH⁺); HRMS Calcd. for C₃₁H₃₂F₃N₆O₇ S₃ (MH⁺): 753.1447. Found: 753.1468.

EXAMPLE 300

20 N-[4-(4-[(2S)-2-Hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-piperidinyl]phenyl]-5-[[5-(trifluoromethyl)-2-pyridinyl]sulfonyl]-2-thiophenesulfonamide

The title compound was prepared from 5-(5-trifluoromethyl-pyridine-2-sulfonyl)-thiophene-2-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide (which was obtained in Example 229) and 4-((2S)-3-amino-2-hydroxy-propoxyl)-phenol (which was obtained in
25 Example 5) according to the procedure of Example 278 as a grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.25-1.45 (m, 2 H), 1.70-1.95 (m, 2 H), 2.50-2.85 (m, 5 H), 3.54 (brd, J = 12.4 Hz, 2 H), 3.65-3.95 (m, 3 H), 6.60-6.90 (m, 8 H), 7.92 (d, J = 1.6 Hz, 1 H), 8.41 (d, J = 8.3 Hz, 1 H), 8.48 (d, J = 1.6 Hz, 1 H), 8.61 (dd, J = 8.3, 2.0 Hz, 1 H), 8.89 (s, 1 H), 9.23 (s, 1 H); MS (ES) m/z: 713.1 (MH⁺); HRMS Calcd. for C₃₀H₃₂F₃N₄O₇ S₃ (MH⁺): 713.1385. Found: 713.1407.

30

EXAMPLE 301

4-[(2,4-Dioxo-1,3-thiazolidin-5-yl)methyl]-N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino]-1-piperidinyl}phenyl}-benzenesulfonamide

The title compound was prepared from 4-(2,4-dioxo-thiazolidin-5-ylmethyl)-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 231) and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) according to the procedure of Example 278 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.60 (m, 2 H), 1.90-2.10 (m, 2 H), 2.50-2.70 (m, 2 H), 2.70-3.50 (m, 5 H), 3.60 (brd, J = 11.6 Hz, 2 H), 4.00 (brs, 3 H), 4.60 (dd, J = 9.4, 4.2 Hz, 1 H), 6.58 (d, J = 7.8 Hz, 1 H), 6.62 (d, J = 8.1 Hz, 1 H), 6.70-6.90 (m, 5 H), 7.35 (d, J = 8.4 Hz, 2 H), 7.55 (d, J = 8.4 Hz, 2 H), 9.70 (brs, 1 H), 10.61 (brs, 1 H), 10.72 (brs, 1 H); MS (ES) m/z: 667.0 (MH⁺); HRMS Calcd. for C₃₁H₃₅N₆O₇S₂ (MH⁺): 677.2009. Found: 677.1999.

EXAMPLE 302

4-[(2,4-Dioxo-1,3-thiazolidin-5-yl)methyl]-N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)-amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl) benzenesulfonamide

The title compound was prepared from 4-(2,4-dioxo-thiazolidin-5-ylmethyl)-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 231) and N-[5-(2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 9) according to the procedure of Example 278 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.45-1.60 (m, 2 H), 1.85-2.05 (m, 2 H), 2.50-3.50 (m, 7 H), 2.93 (s, 3 H), 3.59 (brd, J = 11.9 Hz, 2 H), 4.28 (dd, J = 7.0, 3.8 Hz, 1 H), 4.60-4.65 (m, 1 H), 6.70-6.90 (m, 5 H), 7.05 (dd, J = 8.3, 1.9 Hz, 1 H), 7.21 (d, J = 1.9 Hz, 1 H), 7.33 (d, J = 8.3 Hz, 2 H), 7.55 (d, J = 8.3 Hz, 2 H); MS (ES) m/z: 690.0 (MH⁺); HRMS Calcd. for C₃₀H₃₆N₅O₈S₃ (MH⁺): 690.1726. Found: 690.1714.

EXAMPLE 303

N-{4-[4-((2S)-2-Hydroxy-3-[(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-5-quinolinyl)oxy]-propyl)-amino]-1-piperidinyl}phenyl}-3,4-dimethoxybenzenesulfonamide

The title compound was prepared from 3,4-dimethoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 242) and 5-(3-amino-(2S)-2-hydroxy-propoxy)-8-hydroxy-3,4-dihydro-1H-quinolin-2-one (which was obtained in Example 12) according to the procedure of Example 278 as a white solid; ¹H NMR (300 MHz, DMSO-

d₆) δ 1.20-1.40 (m, 2 H), 1.80-1.95 (m, 2 H), 2.39 (t, J = 7.2 Hz, 2 H), 2.50-2.75 (m, 5 H), 2.82 (t, J = 7.2 Hz, 2 H), 3.45-3.55 (m, 2 H), 3.63 (s, 3 H), 3.72(s, 3 H), 3.70-3.85 (m, 3 H), 4.91 (brs, 1 H), 6.44 (d, J = 8.8 Hz, 1 H), 6.60 (d, J = 8.8 Hz, 1 H), 6.78 (d, J = 9.1 Hz, 1 H), 6.88 (d, J = 9.1 Hz, 1 H), 7.02 (d, J = 8.5 Hz, 1 H), 7.18 (dd, J = 8.5, 2.1 Hz, 1 H), 7.36 (d, J = 2.1 Hz, 1 H), 8.72 (s, 1 H), 9.17 (brs, 1 H); MS (ES) m/z: 627.1 (MH⁺); HRMS Calcd. for C₃₁H₃₉N₄O₈S (MH⁺): 627.2489. Found: 627.2458.

EXAMPLE 304

N-[4-(4-(((2S)-2-Hydroxy-3-(4-hydroxyphenoxy)propyl)amino)-1-piperidinyl)phenyl]-1-octanesulfonamide

The title compound was prepared from octane-1-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide (which was obtained in Example 230) and 4-((2S)-3-amino-2-hydroxy-propoxy)-phenol (which was obtained in Example 5) according to the procedure of Example 278 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.85(t, J = 7.0 Hz, 3 H), 1.15-1.45 (m, 12 H), 1.50-1.70 (m, 2 H), 1.80-1.95 (m, 2 H), 2.50-2.80 (m, 5 H), 2.92 (brt, J = 6.7 Hz, 2 H), 3.54 (brd, J = 12.3 Hz, 2 H), 3.70-3.90 (m, 3 H), 6.66 (d, J = 6.7 Hz, 2 H), 6.75 (d, J = 8.3 Hz, 1 H), 6.88 (d, J = 9.0 Hz, 2 H), 7.04 (d, J = 9.0 Hz, 2 H), 8.89 (brs, 1 H), 9.28 (brs, 1 H); MS (ES) m/z: 534.1 (MH⁺); HRMS Calcd. for C₂₈H₄₄N₃O₅S (MH⁺): 534.3002. Found: 534.3017.

EXAMPLE 305

4-(((Hexylamino)carbonyl)amino)-N-[4-[4-(((2S)-2-hydroxy-3-[(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-5-quinolinyloxy)propyl]amino)-1-piperidinyl)phenyl] benzenesulfonamide

The title compound was prepared from 4-(3-hexyl-ureido)-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 225) and 5-(3-amino-(2S)-2-hydroxy-propoxy)-8-hydroxy-3,4-dihydro-1H-quinolin-2-one (which was obtained in Example 12) according to the procedure of Example 278 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.86 (t, J = 5.1 Hz, 3 H), 1.20-1.35 (m, 8 H), 1.35-1.50 (m, 2 H), 1.75-1.90 (m, 2 H), 2.39 (t, J = 5.1 Hz, 2 H), 2.50-2.75 (m, 5 H), 2.82 (t, J = 5.1 Hz, 2 H), 3.05 (q, J = 5.1 Hz, 2 H), 3.40-3.55 (m, 2 H), 3.75-3.85 (m, 3 H), 4.90 (brs, 1 H), 6.30 (t, J = 5.1 Hz, 1 H), 6.44 (d, J = 6.6 Hz, 1 H), 6.59 (d, J = 6.6 Hz, 1 H), 6.76 (d, J = 6.9 Hz, 1 H), 6.85 (d, J = 6.9 Hz, 1 H), 7.46 (d, J = 6.9 Hz, 2 H), 7.50 (d, J = 6.9 Hz, 2 H), 8.67 (s, 1 H), 8.84 (s, 1 H), 9.10 (brs, 1 H), 9.50 (brs, 1 H); MS (ES) m/z: 709.2 (MH⁺); HRMS Calcd. for C₃₆H₄₉N₆O₇S (MH⁺): 709.3383. Found: 709.3391.

EXAMPLE 306

N-{4-[4-(((2S)-2-Hydroxy-3-[(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-5-quinolinyl)oxy]propyl)-amino)-1-piperidinyl]phenyl}-1-butanesulfonamide

The title compound was prepared from butane-1-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide (which was obtained in Example 228) and 5-(3-amino-(2S)-2-hydroxy-propoxy)-8-hydroxy-3,4-dihydro-1H-quinolin-2-one (which was obtained in Example 12) according to the procedure of Example 278 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.82 (t, J = 7.3 Hz, 3 H), 1.20-1.40 (m, 4 H), 1.50-1.70 (m, 2 H), 1.80-1.95 (m, 2 H), 2.39 (t, J = 7.3 Hz, 2 H), 2.50-2.80 (m, 5 H), 2.85 (t, J = 7.3 Hz, 2 H), 2.85-3.00 (m, 2 H), 3.45-3.60 (m, 2 H), 3.75-3.85 (m, 3 H), 6.44 (d, J = 8.7 Hz, 1 H), 6.60 (d, J = 8.7 Hz, 1 H), 6.89 (d, J = 9.0 Hz, 2 H), 7.04 (d, J = 9.0 Hz, 2 H), 8.74 (s, 1 H); MS (ES) m/z: 546.9 (MH⁺); HRMS Calcd. for C₂₇H₃₉N₄O₆S (MH⁺): 547.2590. Found: 547.2583.

EXAMPLE 307

N-[4-((4-[4-(((2S)-2-Hydroxy-3-[(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-5-quinolinyl)oxy]propyl)-amino)-1-piperidinyl]anilino)sulfonyl)phenyl]acetamide

The title compound was prepared from N-{4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide (which was obtained in Example 216) and 5-(3-amino-(2S)-2-hydroxy-propoxy)-8-hydroxy-3,4-dihydro-1H-quinolin-2-one (which was obtained in Example 12) according to the procedure of Example 278 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.75-1.90 (m, 2 H), 2.05 (s, 3 H), 2.39 (t, J = 7.5 Hz, 2 H), 2.50-2.80 (m, 5 H), 2.83 (t, J = 7.5 Hz, 2 H), 3.40-3.55 (m, 2 H), 3.70-3.85 (m, 3 H), 6.44 (d, J = 8.7 Hz, 1 H), 6.60 (d, J = 8.7 Hz, 1 H), 6.76 (d, J = 9.0 Hz, 2 H), 6.85 (d, J = 9.0 Hz, 2 H), 7.58 (d, J = 9.0 Hz, 2 H), 7.67 (d, J = 9.0 Hz, 2 H), 8.72 (s, 1 H), 10.27 (s, 1 H); MS (ES) m/z: 623.9 (MH⁺); HRMS Calcd. for C₃₁H₃₈N₅O₇S (MH⁺): 624.2492. Found: 624.2469.

EXAMPLE 308

N-(4-{4-(((2S)-2-Hydroxy-3-{4-hydroxy-3-[(methylsulfonyl)amino]phenoxy}propyl)-amino)-1-piperidinyl}phenyl)-4-dimethoxybenzenesulfonamide

The title compound was prepared from 3,4-dimethoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 242) and N-[5-((2S)-3-amino-2-hydroxy-propoxy)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 14) according to the procedure of Example 278 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.75-1.90 (m, 2 H), 2.50-2.80 (m, 5 H), 2.92 (s, 3 H), 3.40-3.55 (m, 2 H),

3.71 (s, 3 H), 3.78 (s, 3 H), 3.70-3.85 (m, 3 H), 6.60 (dd, J = 8.8, 2.9 Hz, 1 H), 6.70-6.85 (m, 5 H), 6.88 (d, J = 9.0 Hz, 2 H), 7.02 (d, J = 8.6 Hz, 2 H), 7.16 (d, J = 2.1 Hz, 1 H), 7.23 (dd, J = 8.4, 2.1 Hz, 1 H); MS (ES) m/z: 650.9 (MH⁺); HRMS Calcd. for C₂₉H₃₉N₄O₉S₂ (MH⁺): 651.2158. Found: 651.2117.

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EXAMPLE 309

N-(4-{4-[(2S)-2-Hydroxy-3-{4-hydroxy-3-[(methylsulfonyl)amino]phenoxy}-propyl)amino]-1-piperidinyl}phenyl)-1-butanesulfonamide

The title compound was prepared from butane-1-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide (which was obtained in Example 228) and N-[5-((2S)-3-amino-2-hydroxy-propoxy)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 14) according to the procedure of Example 278 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.83 (t, J = 7.3 Hz, 3 H), 1.25-1.40 (m, 2 H), 1.55-1.70 (m, 2 H), 1.80-1.95 (m, 2 H), 2.50-2.80 (m, 5 H), 2.92 (s, 3 H), 2.85-3.30 (m, 2 H), 3.50-3.65 (m, 2 H), 3.70-3.90 (m, 3 H), 6.61 (dd, J = 8.8, 2.9 Hz, 1 H), 6.70-6.80 (m, 2 H), 6.88 (d, J = 8.9 Hz, 2 H), 7.05 (d, J = 8.9 Hz, 2 H); MS (ES) m/z: 571.0 (MH⁺); HRMS Calcd. for C₂₅H₃₉N₄O₇S₂ (MH⁺): 571.2261. Found: 571.2279.

EXAMPLE 310

4-[(Hexylamino)carbonyl]amino-N-(4-{4-[(2S)-2-hydroxy-3-{4-hydroxy-3-[(methylsulfonyl)amino]phenoxy}propyl)amino]-1-piperidinyl}phenyl)benzenesulfonamide

The title compound was prepared from 4-(3-hexyl-ureido)-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 225) and N-[5-((2S)-3-amino-2-hydroxy-propoxy)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 14) according to the procedure of Example 278 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.86 (t, J = 6.9 Hz, 3 H), 1.25-1.40 (m, 8 H), 1.30-1.45 (m, 2 H), 1.75-1.90 (m, 2 H), 2.50-2.75 (m, 5 H), 2.92 (s, 3 H), 3.00-3.15 (m, 2 H), 3.45-3.55 (m, 2 H), 3.70-3.90 (m, 3 H), 6.32 (t, J = 5.6 Hz, 1 H), 6.60 (dd, J = 8.8, 2.9 Hz, 1 H), 6.70-6.80 (m, 4 H), 6.85 (d, J = 9.1 Hz, 2 H), 7.45 (d, J = 6.8 Hz, 2 H), 7.50 (d, J = 6.8 Hz, 2 H), 8.64 (brs, 1 H); MS (ES) m/z: 733.1 (MH⁺); HRMS Calcd. for C₃₄H₄₉N₆O₈S₂ (MH⁺): 733.3053. Found: 733.3049.

EXAMPLE 311

N-[4-(4-[(2R)-2-(3-Chlorophenyl)-2-hydroxyethyl]amino)-1-piperidinyl]phenyl]-4-[(hexylamino)-carbonyl]amino]benzenesulfonamide

The title compound was prepared from 4-(3-hexyl-ureido)-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide (which was obtained in Example 225) and (1R)-2-amino-1-(3-chloro-phenyl)-ethanol (which was obtained in Example 1) according to the procedure of Example 278 as a brown solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.84 (t, J = 6.9 Hz, 3 H), 1.20-1.50 (m, 10 H), 1.75-1.90 (m, 2 H), 2.50-2.80 (m, 5 H), 3.00-3.15 (m, 2 H), 3.40-3.50 (m, 2 H), 4.60 (dd, J = 8.1, 3.8 Hz, 1 H), 6.29 (t, J = 5.7 Hz, 1 H), 6.77 (d, J = 9.1 Hz, 2 H), 6.85 (d, J = 9.1 Hz, 2 H), 7.25-7.50 (m, 8 H), 8.94 (s, 1 H), 9.55 (brs, 1 H); MS (ES) m/z: 628.1 (MH⁺); HRMS Calcd. for C₃₂H₄₃ClN₅O₄S (MH⁺): 628.2748. Found: 628.2718.

EXAMPLE 312

Ethyl{4-[4-{4-[(2S)-2-hydroxy-3-{4-hydroxy-3-[(methylsulfonyl)amino]-phenoxy}propyl)amino]-1-piperidinyl}anilino)sulfonyl]phenyl}acetate

The title compound was prepared from {4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenyl}-acetic acid methyl ester (which was prepared according to the procedure of Example 225) and N-[5-((2S)-3-amino-2-hydroxy-propoxy)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 14) according to the procedure of Example 278 as a brown solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.16 (t, J = 7.1 Hz, 3 H), 1.20-1.40 (m, 2 H), 1.75-1.90 (m, 2 H), 2.50-2.80 (m, 5 H), 2.91 (s, 3 H), 3.40-3.55 (m, 2 H), 3.74 (s, 2 H), 3.70-3.85 (m, 3 H), 4.07 (q, J = 7.1 Hz, 2 H), 6.59 (dd, J = 8.8, 3.0 Hz, 1 H), 6.70-6.80 (m, 4 H), 6.87 (d, J = 9.1 Hz, 2 H), 7.41 (d, J = 8.4 Hz, 2 H), 7.63 (d, J = 8.4 Hz, 2 H); MS (ES) m/z: 677.0 (MH⁺); HRMS Calcd. for C₃₁H₄₁N₄O₉S₂ (MH⁺): 677.2315. Found: 677.2289.

EXAMPLE 313

Methyl{4-[4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]-phenyl}ethyl)amino]-1-piperidinyl}anilino)sulfonyl]phenoxy}acetate

The title compound was prepared from {4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenoxy}-acetic acid methyl ester (which was obtained in Example 232) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 278 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.75-1.90 (m, 2 H), 2.50-2.80 (m, 5 H), 2.92 (s, 3 H), 3.65-3.75 (m, 2 H), 3.67 (s, 3 H), 4.47 (dd, J = 8.0, 4.1 Hz, 1 H), 4.87 (s, 2 H), 6.50-6.90 (m, 8

H), 7.17 (d, J = 1.8 Hz, 1 H), 7.59 (d, J = 8.9 Hz, 2 H); MS (ES) m/z: 649.0 (MH⁺); HRMS Calcd. for C₂₉H₃₇N₄O₉S₂ (MH⁺): 649.2004. Found: 649.2014.

EXAMPLE 314

5 Methyl[4-({4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino]-1-piperidiny]anilino)sulfonyl}phenoxy]acetate

The title compound was prepared from {4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenoxy}-acetic acid methyl ester (which was obtained in Example 232) and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) according to the
 10 procedure of Example 278 as a pale yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.75-1.90 (m, 2 H), 2.50-2.85 (m, 5 H), 3.30-3.50 (m, 2 H), 3.69 (s, 3 H), 3.80-4.05 (m, 3 H), 4.87 (s, 2 H), 6.56 (d, J = 7.8 Hz, 1 H), 6.61 (d, J = 8.1 Hz, 1 H), 6.65-6.90 (m, 5 H), 7.02 (d, J = 9.0 Hz, 2 H), 7.59 (d, J = 9.0 Hz, 2H), 10.60 (s, 1 H), 10.75 (brs, 1 H); MS (ES) m/z: 626.1 (MH⁺); HRMS Calcd. for C₃₀H₃₆N₅O₈S (MH⁺): 626.2285. Found: 626.2298.

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EXAMPLE 315

N-[5-((2S)-3-[(1-{4-[(Butylsulfonyl)amino]phenyl}-4-piperidiny]amino)-2-hydroxypropyl)oxy)-2-hydroxyphenyl]benzenesulfonamide

The title compound was prepared from butane-1-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide (which was obtained in Example 228) and N-[5-((2S)-3-amino-2-hydroxypropoxy)-2-hydroxy-phenyl]- benzenesulfonamide (which was obtained in Example 21) according to the procedure of Example 278 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.83 (t, J = 7.3 Hz, 3 H), 1.20-1.40 (m, 4 H), 1.55-1.70 (m, 2 H), 1.80-1.95 (m, 2 H), 2.50-2.80 (m, 5 H), 2.92 (t, J = 7.6 Hz, 2 H), 3.50-3.90 (m, 5 H), 6.39 (d, J = 8.7, 2.9 Hz, 1 H), 6.57
 25 (d, J = 8.7 Hz, 1 H), 6.72 (d, J = 2.9 Hz, 1 H), 6.90 (d, J = 9.0 Hz, 2H), 7.05 (d, J = 9.0 Hz, 2 H), 7.40-7.60 (m, 3 H), 7.74 (d, J = 7.7 Hz, 2 H); MS (ES) m/z: 633.1 (MH⁺); HRMS Calcd. for C₃₀H₄₁N₄O₇S₂ (MH⁺): 633.2411. Found: 633.2409.

EXAMPLE 316

30 N-(4-{4-[(2R)-2-Hydroxy-2-{4-hydroxy-3-[(isopropylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidiny]phenyl)-1-butanefulfonamide

The title compound was prepared from butane-1-sulfonic acid [4-(4-oxo-piperidin-1-yl)-phenyl]-amide (which was obtained in Example 228) and propane-2-sulfonic acid [5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-amide (which was obtained in Example 27)

according to the procedure of Example 278 as an off-white solid; ^1H NMR (300 MHz, DMSO- d_6) δ 0.83 (t, $J = 7.3$ Hz, 3 H), 1.20-1.40 (m, 4 H), 1.25 (d, $J = 6.8$ Hz, 6 H), 1.55-1.75 (m, 2 H), 1.75-1.90 (m, 2 H), 2.50-2.75 (m, 5 H), 2.92 (t, $J = 7.7$ Hz, 2 H), 3.05-3.15 (m, 1 H), 3.45-3.60 (m, 2 H), 4.46 (dd, $J = 7.8, 4.5$ Hz, 1 H), 6.78 (d, $J = 8.2$ Hz, 1 H), 6.88 (d, $J = 9.0$ Hz, 2 H), 6.96 (dd, $J = 8.2, 2.0$ Hz, 1H), 7.04 (d, $J = 9.0$ Hz, 2 H), 7.23 (d, $J = 2.0$ Hz, 1 H); MS (ES) m/z : 569.0 (MH^+); HRMS Calcd. for $\text{C}_{26}\text{H}_{41}\text{N}_4\text{O}_6\text{S}_2$ (MH^+): 569.2462. Found: 569.2458.

EXAMPLE 317

4-[(4-{4-[(2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl} ethyl)amino]-1-piperidinyl}anilino)sulfonyl]benzoic acid

The title compound was prepared from 4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-benzoic acid (which was obtained in Example 233) and N-[5-((1R)-2-amino-1-hydroxy- ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 278 as a white solid; ^1H NMR (300 MHz, DMSO- d_6) δ 1.35-1.50 (m, 2 H), 1.75-2.00 (m, 2 H), 2.50-2.95 (m, 5 H), 2.92 (s, 3 H), 3.45-3.60 (m, 2 H), 4.60-4.70 (m, 1 H), 6.77 (d, $J = 9.3$ Hz, 2 H), 6.80-6.90 (m, 3 H), 7.02 (dd, $J = 8.4, 1.8$ Hz, 1 H), 7.20 (d, $J = 1.8$ Hz, 1 H), 7.60 (d, $J = 8.4$ Hz, 2H), 7.93 (d, $J = 8.4$ Hz, 2 H); MS (ES) m/z : 603.2 (M-H^-); HRMS Calcd. for $\text{C}_{27}\text{H}_{31}\text{N}_4\text{O}_8\text{S}_2$ (M-H^-): 603.1588. Found: 603.1572.

EXAMPLE 318

Ethyl 4-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl} ethyl)-amino]-1-piperidinyl}anilino)sulfonyl]benzoate

The title compound was prepared from 4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-benzoic acid ethyl ester (which was obtained in Example 235) and N-[5-((1R)-2-amino-1-hydroxy- ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 278 as a pale yellowish solid; ^1H NMR (300 MHz, DMSO- d_6) δ 1.20-1.40 (m, 2 H), 1.32 (t, $J = 7.1$ Hz, 3 H), 1.75-1.90 (m, 2 H), 2.50-2.70 (m, 5 H), 2.91 (s, 3 H), 3.40-3.55 (m, 2 H), 4.32 (q, $J = 7.1$ Hz, 2 H), 4.47 (dd, $J = 8.1, 4.2$ Hz, 1 H), 6.70-6.90 (m, 5 H), 6.99 (dd, $J = 8.3, 2.0$ Hz, 1 H), 7.17 (d, $J = 2.0$ Hz, 1 H), 7.79 (d, $J = 8.5$ Hz, 2 H), 8.07 (d, $J = 8.5$ Hz, 2 H); MS (ES) m/z : 633.3 (MH^+); HRMS Calcd. for $\text{C}_{29}\text{H}_{37}\text{N}_4\text{O}_8\text{S}_2$ (MH^+): 633.2047. Found: 633.2013.

EXAMPLE 319

Methyl{4-[4-[4-(((2R)-2-{4-chloro-3-[(methylsulfonyl)amino]phenyl)-2-hydroxyethyl)amino]-1-piperidinyl}anilino)sulfonyl]phenoxy}acetate

The title compound was prepared from {4-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-phenoxy}-acetic acid methyl ester (which was obtained in Example 232) and N-[5-((1R)-2-azido-1-hydroxy-ethyl)-2-chloro-phenyl]-methanesulfonamide (which was obtained in Example 25) according to the procedure of Example 95 as a pale grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.75-1.90 (m, 2 H), 2.50-2.80 (m, 5 H), 2.97 (s, 3 H), 3.40-3.55 (m, 2 H), 3.69 (s, 3 H), 4.63 (dd, J = 8.0, 3.8 Hz, 1 H), 4.87 (s, 2 H), 6.77 (d, J = 9.0 Hz, 2 H), 6.87 (d, J = 9.0 Hz, 2 H), 7.03 (d, J = 9.0 Hz, 2 H), 7.17 (dd, J = 8.3, 1.7 Hz, 1 H), 7.43 (d, J = 8.3 Hz, 1 H), 7.43 (d, J = 1.7 Hz, 1 H), 7.62 (d, J = 9.0 Hz, 2 H); MS (ES) m/z: 667.0 (MH⁺); HRMS Calcd. for C₂₉H₃₆ClN₄O₈S₂ (MH⁺): 667.1657. Found: 667.1651.

EXAMPLE 320

Methyl3-[4-[4-[4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino)-1-piperidinyl}anilino)sulfonyl]-2-thiophenecarboxylate

The title compound was prepared from 3-[4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-thiophene-2-carboxylic acid methyl ester (which was obtained in Example 234) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 278 as a pale yellowish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.70-1.90 (m, 2 H), 2.50-2.75 (m, 5 H), 3.40-3.55 (m, 2 H), 3.89 (s, 2 H), 4.46 (dd, J = 8.0, 4.2 Hz, 1 H), 6.75-6.85 (m, 3 H), 6.90 (d, J = 9.0 Hz, 2 H), 7.00 (dd, J = 8.3, 2.0 Hz, 1 H), 7.16 (d, J = 2.0 Hz, 1 H), 7.32 (d, J = 3.3 Hz, 1 H), 7.89 (d, J = 3.3 Hz, 1 H); MS (ES) m/z: 624.9 (MH⁺); HRMS Calcd. for C₂₆H₃₄N₄O₈S₃ (MH⁺): 625.1455. Found: 625.1441.

EXAMPLE 321

3-[4-[4-[4-(((2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl) amino)-1-piperidinyl}anilino)sulfonyl]-2-thiophenecarboxylic acid

The title compound was prepared from methyl 3-[4-[4-[4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino)-1-piperidinyl}anilino)sulfonyl]-2-thiophenecarboxylate (which was obtained in Example 320) by NaOH hydrolysis as a pale grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.50-1.70 (m, 2 H), 1.95-2.10 (m, 2 H), 2.50-2.70 (m, 2 H), 2.95 (s, 3 H), 3.00-3.30 (m, 3 H), 3.60-3.70 (m, 2 H), 4.75-4.85 (m, 1 H), 6.10 (brs, 1 H), 6.80 (d, J =

9.0 Hz, 2 H), 6.85-6.95(m, 3 H), 7.04 (d, J = 5.4 Hz, 1 H), 7.08 (dd, J = 8.4, 1.8 Hz, 1 H), 7.26 (d, J = 1.8 Hz, 1 H), 7.39 (d, J = 5.4 Hz, 1 H), 8.73 (brs, 1 H), 9.96 (brs, 1 H); MS (ES) m/z: 610.7 (MH⁺); HRMS Calcd. for C₂₅H₃₁N₄O₈S₃ (MH⁺): 611.1299. Found: 611.1284.

5 EXAMPLE 322

Benzyl[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}anilino)sulfonyl]acetate

The title compound was prepared from [4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-acetic acid benzyl ester (which was obtained in Example 236) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 278 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.70-1.95 (m, 2 H), 2.50-2.75 (m, 2 H), 2.92 (s, 3 H), 3.50-3.60 (m, 3 H), 4.13 (s, 2 H), 4.48 (dd, J = 8.0, 4.3 Hz, 1 H), 5.15 (s, 2 H), 6.82 (d, J = 8.3 Hz, 1 H), 6.86 (d, J = 9.0 Hz, 2 H), 7.00 (dd, J = 8.3, 2.0 Hz, 1 H), 7.06 (d, J = 9.0 Hz, 2 H), 7.18 (d, J = 2.0 Hz, 1 H), 7.30-7.40 (m, 5 H); MS (ES) m/z: 633.3 (MH⁺); HRMS Calcd. for C₂₉H₃₇N₄O₈S₂ (MH⁺): 633.2047. Found: 633.2031.

EXAMPLE 323

[(4-{4-[(2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl) amino]-1-piperidinyl}anilino)sulfonyl]acetic acid

The title compound was prepared from [4-(4-oxo-piperidin-1-yl)-phenylsulfamoyl]-acetic acid benzyl ester (which was obtained in Example 236) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 255 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.40-1.60 (m, 2 H), 1.90-2.05 (m, 2 H), 2.50-2.90 (m, 5 H), 2.94 (s, 3 H), 3.50-3.65 (m, 2 H), 4.65-4.75 (m, 1 H), 6.80-6.90 (m, 3 H), 7.00-7.10 (m, 3 H), 7.23 (d, J = 2.0 Hz, 1 H); MS (ES) m/z: 543.3 (MH⁺); HRMS Calcd. for C₂₉H₃₇N₄O₈S₂ (MH⁺): 543.1578. Found: 543.1572.

EXAMPLE 324

Benzyl[(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)-amino]-1-piperidinyl}anilino)sulfonyl]acetate

The title compound was prepared from benzyl {[butyl-4-(4-oxo-1-piperidinyl)anilino]-sulfonyl}acetate (which was obtained in Example 253) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according

to the procedure of Example 278 as an off-white solid; ^1H NMR (300 MHz, DMSO- d_6) δ 0.79 (t, $J = 7.2$ Hz, 3 H), 1.10-1.40 (m, 6 H), 1.80-1.95 (m, 2 H), 2.55-2.80 (m, 5 H), 2.92 (s, 3 H), 3.45 (t, $J = 7.1$ Hz, 2 H), 4.24 (s, 2 H), 4.49(dd, $J = 7.9, 4.2$ Hz, 1 H), 5.20 (s, 2 H), 6.82 (d, $J = 8.2$ Hz, 1 H), 6.92 (d, $J = 9.0$ Hz, 2 H), 7.00 (dd, $J = 8.2, 2.0$ Hz, 1 H), 7.10-7.20 (m, 3 H), 7.30-7.45 (m, 5 H); MS (ES) m/z : 689.1 (MH^+); HRMS Calcd. for $\text{C}_{33}\text{H}_{45}\text{N}_4\text{O}_8\text{S}_2$ (MH^+): 689.2673. Found: 689.2679.

EXAMPLE 325

[(Butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidiny]anilino)sulfonyl]acetic acid

The title compound was prepared from benzyl {[butyl-4-(4-oxo-1-piperidiny]anilino]-sulfonyl]acetate (which was obtained in Example 253) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 255 as a pale grey solid; ^1H NMR (300 MHz, DMSO- d_6) δ 0.79(t, $J = 7.1$ Hz, 3 H), 1.10-1.35 (m, 4 H), 1.50-1.70 (m, 2 H), 2.00-2.10 (m, 2 H), 2.55-3.10 (m, 5 H), 2.92 (s, 3 H), 3.55-3.70 (m, 2 H), 3.70-3.85 (m, 2 H), 4.75-4.85 (m, 1 H), 6.88 (d, $J = 8.3$ Hz, 1 H), 6.92 (d, $J = 9.0$ Hz, 2 H), 7.08 (dd, $J = 8.3, 2.0$ Hz, 1 H), 7.20-7.35 (m, 3 H); MS (ES) m/z : 597.1 (M-H^-); HRMS Calcd. for $\text{C}_{26}\text{H}_{39}\text{N}_4\text{O}_8\text{S}_2$ (MH^+): 599.2204. Found: 599.2218.

EXAMPLE 326

N-(4-{4-[(2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl} ethyl)amino]-1-piperidiny]phenyl)-3-pyridinesulfonamide

To a stirred mixture of pyridine-3-sulfonic acid-[4-(4-oxo piperidin-1-yl)-phenyl] amide (which was obtained in Example 237) (0.94 g, 2.8 mmol), N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) (0.70 g, 2.8 mmol) in dimethylformamide (10 mL) at room temperature was added sodium triacetoxyborohydride (0.72 g, 3.4 mmol) and glacial acid (0.18 mL, 3.1 mmol). The reaction was stirred under N_2 atmosphere for 18 hours. The reaction mixture was poured onto 1:1 water/ saturated sodium bicarbonate, extracted with ethyl acetate three times, dried over sodium sulfate and concentrated. The product was purified by flash silica gel chromatography eluting with 10% methanol in methylene chloride and finally with 20% methanol in methylene chloride to give the titled compound as a yellow solid (0.23 g, 15%); ^1H NMR (300 MHz, DMSO- d_6) δ 1.25-1.45 (m, 2 H), 1.80-1.95(m, 2 H), 2.50-2.80(m, 5 H), 2.92(s, 3 H), 3.40-3.55(m, 2 H), 4.45-4.60(m, 1 H), 6.85-6.90(m, 5 H), 7.02(dd, $J = 8.3, 2.0$ Hz, 1 H), 7.18(d, $J = 2.0$ Hz, 1 H), 7.59(dd, $J = 7.4, 4.4$

Hz, 1 H), 7.95-8.05(m, 2 H), 8.70-8.80(m, 2 H); MS (ES) m/z: 561.95 (MH⁺, 100%); HRMS Calcd. for C₂₅H₃₂N₅O₆S₂(MH⁺): 562.1788. Found: 562.1774.

EXAMPLE 327

5 3,4-Dichloro-N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino]-1-piperidinyl}phenyl}benzenesulfonamide

The title compound was prepared according to the procedure of Example 326 as a yellow solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.29-1.41 (m, 2H), 1.87-1.91 (m, 2H), 2.60-2.75 (m, 5H), 2.82-2.93 (m, 1H), 3.53-3.57 (m, 2H), 3.88-4.04 (m, 4H), 4.99 (brs, 1H), 6.55-6.63 (m, 10 2H), 6.79-6.89 (m, 5H), 7.55-7.60 (m, 1H), 7.81-7.95 (m, 2H), 10.58 (s, 1H), 10.70 (brs, 1H); MS (ES) m/z: 605.9 (MH⁺); HRMS found for C₂₇H₂₉Cl₂N₅O₅S: 606.1323.

EXAMPLE 328

15 N-{4-[4-((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy] propyl)-amino]-1-piperidinyl}phenyl}-4-(trifluoromethyl)benzenesulfonamide

The title compound was prepared according to the procedure of Example 326 as a yellow solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.33-1.37 (m, 2H), 1.87-1.90 (m, 2H), 2.59-2.69 (m, 4H), 2.72-2.76 (m, 1H), 2.84-2.96 (m, 1H), 3.47-3.56 (m, 2H), 3.92-4.04 (m, 4H), 5.01 (brs, 1H), 6.55-6.63 (m, 2H), 6.78-6.94 (m, 5H), 7.87 (d, J = 8.4 Hz, 2H), 7.94 (d, J = 8.4 Hz, 2H), 20 10.5 (s, 1H), 10.7 (brs, 1H); MS (ES) m/z: 606.1 (MH⁺); HRMS found for C₂₈H₃₀F₃N₅O₅S: 606.1989.

EXAMPLE 329

25 N-{4-[4-((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy] propyl)-amino]-1-piperidinyl}phenyl}-4-(trifluoromethoxy)benzenesulfonamide

The title compound was prepared according to the procedure of Example 326 as a yellow solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.32-1.36 (m, 2H), 1.86-1.90 (m, 2H), 2.58-2.73 (m, 6H), 2.81-2.89 (m, 1H), 3.51-3.55 (m, 2H), 3.91-3.96 (m, 2H), 3.99-4.04 (m, 1H), 4.95 (brs, 1H), 6.55-6.63 (m, 2H), 6.78-6.89 (m, 5H), 7.54 (d, J = 8.1 Hz, 2H), 7.76-7.82 (m, 2H), 10.5 (s, 30 1H), 10.65 (brs, 1H); MS (ES) m/z: 622.0 (MH⁺); HRMS found for C₂₈H₃₀F₃N₅O₆S: 622.1961.

EXAMPLE 330

N-{4-[4-((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino)-1-piperidinyl]phenyl}-4-methoxybenzenesulfonamide

The title compound was prepared according to the procedure of Example 326 as a grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.23-1.36 (m, 2H), 1.84-1.88 (m, 2H), 2.57-2.73 (m, 6H), 2.76-2.82 (m, 1H), 3.48-3.52 (m, 2H), 3.79 (s, 3H), 3.87-3.95 (m, 2H), 3.99-4.04 (m, 1H), 4.90 (brs, 1H), 6.55-6.63 (m, 2H), 6.75-6.88 (m, 5H), 7.00-7.05 (m, 2H), 7.57-7.68 (m, 2H), 10.65 (s, 1H), 10.8 (brs, 1H); MS (ES) m/z: 568.1 (MH⁺); HRMS found for C₂₈H₃₃N₅O₆S: 568.220.

EXAMPLE 331

4-Chloro-N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino)-1-piperidinyl]phenyl}benzenesulfonamide

The title compound was prepared according to the procedure of Example 326 as a grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.23-1.39 (m, 2H), 1.90-1.99 (m, 2H), 2.59-2.73 (m, 6H), 2.81-2.86 (m, 1H), 3.46-3.55 (m, 2H), 3.99-4.04 (m, 2H), 4.07-4.13 (m, 1H), 4.95 (brs, 1H), 6.55-6.62 (m, 2H), 6.67-6.92 (m, 5H), 7.59-7.68 (m, 4H), 10.6 (s, 1H), 10.7 (brs, 1H); MS (ES) m/z: 571.9 (MH⁺); HRMS found for C₂₇H₃₀ClN₅O₅S: 572.1750.

EXAMPLE 332

4-Butyl-N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}benzenesulfonamide

The title compound was prepared according to the procedure of Example 326 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.87 (t, J = 7.23 Hz, 3H), 1.22-1.35 (m, 4H), 1.47-1.58 (m, 2H), 1.86-1.90 (m, 2H), 2.60-2.65 (m, 6H), 2.71-2.72 (m, 2H), 2.73-2.85 (m, 1H), 3.49-3.53 (m, 2H), 3.91-3.99 (m, 1H), 4.01-4.12 (m, 2H), 4.95 (brs, 1H), 6.55-6.63 (m, 2H), 6.75-6.89 (m, 5H), 7.33 (d, J = 8.4 Hz, 2H), 7.57 (d, J = 8.4 Hz, 2H), 10.58 (s, 1H), 10.7 (brs, 1H); MS (ES) m/z: 594.1 (MH⁺); HRMS found for C₃₁H₃₉N₅O₅S: 594.2674.

EXAMPLE 333

3,5-Dichloro-N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino]-1-piperidiny]phenyl}benzenesulfonamide

The title compound was prepared according to the procedure of Example 326 as a tan solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.29-1.40 (m, 2H), 1.87-1.91 (m, 2H), 2.61-2.75 (m, 4H), 2.84-2.88 (m, 2H), 3.46-3.58 (m, 2H), 3.92-3.97 (m, 2H), 3.99-4.04 (m, 2H), 4.99 (brs, 1H), 6.55-6.63 (m, 2H), 6.80-6.94 (m, 5H), 7.6 (d, J = 1.8 Hz, 2H), 7.93 (t, J = 1.8 Hz, 1H), 10.58 (s, 1H), 10.7 (brs, 1H); MS (ES) m/z: 606.0 (MH⁺); HRMS found for C₂₇H₂₉Cl₂N₅O₅S: 606.1291.

EXAMPLE 334

N-{4-[4-((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino]-1-piperidiny]phenyl}-2,5-dimethoxybenzenesulfonamide

The title compound was prepared according to the procedure of Example 326 as a yellow solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.23-1.40 (m, 2H), 1.91 (m, 2H), 2.55-2.63 (m, 4H), 2.72-2.73 (m, 1H), 2.82 (m, 1H), 3.44-3.52 (m, 2H), 3.68 (s, 3H), 3.85 (s, 3H), 3.91-4.04 (m, 4H), 4.87 (brs, 1H), 6.55-6.62 (m, 2H), 6.67-6.92 (m, 5H), 7.12-7.13 (m, 3H), 10.57 (s, 1H), 10.69 (brs, 1H); MS (ES) m/z: 598.1 (MH⁺); HRMS found for C₂₉H₃₅N₅O₇S: 598.2343.

EXAMPLE 335

N-(4-{4-(((2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl) amino)-1-piperidiny]phenyl}-2,5-dimethoxybenzenesulfonamide

The title compound was prepared according to the procedure of Example 326 as a yellow solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.34-1.37 (m, 2H), 1.84-1.90 (m, 2H), 2.53-2.66 (m, 2H), 2.69-2.75 (m, 3H), 2.92 (s, 3H), 3.01-3.08 (m, 2H), 3.49-3.53 (m, 2H), 3.68 (s, 3H), 3.85 (s, 3H), 4.55-4.57 (m, 2H), 5.4 (brs, 1H), 6.53 (d, J = 7.8 Hz, 2H), 6.70-6.92 (m, 3H), 6.99-7.04 (m, 2H), 7.12 (d, J = 2.61 Hz, 2H), 7.19 (d, J = 1.92 Hz, 1H), 9.44 (brs, 1H); MS (ES) m/z: 621.0 (MH⁺); HRMS found for C₂₈H₃₆N₄O₈S₂: 621.2049.

EXAMPLE 336

Ethyl{[(4-butylphenyl)sulfonyl]-4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]anilino}acetate

The title compound was prepared according to the procedure of Example 326 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.89 (t, J = 7.26 Hz, 3H), 1.13 (t, J = 7.11 Hz, 3H), 1.23-1.36 (m, 4H), 1.48-1.62 (m, 2H), 1.86-1.90 (m, 2H), 2.26-2.28 (m, 2H), 2.58 (m, 1H), 2.63-2.71 (m, 4H), 2.74-2.79 (m, 1H), 3.60-3.71 (m, 2H), 3.88-3.96 (m, 2H), 4.00-4.13 (m, 3H), 4.39 (s, 2H), 4.90 (brs, 1H), 6.59 (q, J = 7.59 Hz, 2H), 6.79-6.93 (m, 5H), 7.38 (d, J = 8.31 Hz, 2H), 7.54 (d, J = 8.31 Hz, 2H), 10.6 (s, 1H), 10.7 (brs, 1H); MS (ES) m/z: 680.2 (MH⁺); HRMS found for C₃₅H₄₅N₅O₇S: 680.3112.

EXAMPLE 337

5-Bromo-N-[(5-bromo-2-methoxyphenyl)sulfonyl]-N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}-2-methoxybenzenesulfonamide

The title compound was prepared according to the procedure of Example 326 as a dull yellow solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.23-1.35 (m, 2H), 1.90 (m, 2H), 2.27-2.28 (m, 2H), 2.57-2.73 (m, 2H), 2.79-2.86 (m, 2H), 3.49 (s, 3H), 3.71 (s, 3H), 3.91-3.96 (m, 2H), 4.01-4.06 (m, 2H), 4.13-4.15 (m, 1H), 4.91 (brs, 1H), 6.55-6.64 (m, 2H), 6.82-7.00 (m, 8H), 7.20 (d, J = 9.09 Hz, 1H), 7.60 (d, J = 2.55 Hz, 1H), 7.88 (dd, J = 2.52 Hz, 6.39 Hz, 1H), 10.6 (s, 1H), 10.7 (brs, 1H); MS (ES) m/z: 896.0 (MH⁺); HRMS found for C₃₅H₃₇Br₂N₅O₉S₂: 896.0486.

EXAMPLE 338

5-Bromo-N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino)-1-piperidinyl]phenyl}-2-methoxybenzenesulfonamide

The title compound was prepared according to the procedure of Example 326 as a moss green solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.23-1.37 (m, 2H), 1.84-1.90 (m, 2H), 2.57-2.65 (m, 2H), 2.69-2.73 (m, 2H), 2.80-2.83 (m, 1H), 3.49-3.53 (m, 2H), 3.91 (s, 3H), 3.86-3.96 (m, 2H), 3.99-4.04 (m, 2H), 4.09-4.15 (m, 1H), 4.95 (brs, 1H), 6.55-6.63 (m, 2H), 6.75-6.91 (m, 5H), 7.17 (d, J = 8.94 Hz, 1H), 7.66 (d, J = 2.58 Hz, 1H), 7.73 (dd, J = 2.55 Hz, 6.24 Hz, 1H), 10.55 (s, 1H), 10.65 (brs, 1H); MS (ES) m/z: 647.9 (MH⁺); HRMS found for C₂₈H₃₂BrN₅O₆S: 646.1331.

EXAMPLE 339

Ethyl([(3,4-dimethoxyphenyl)sulfonyl]-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)-amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)acetate

The title compound was prepared according to the procedure of Example 326 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.14 (t, J = 7.08 Hz, 3H), 1.24-1.33 (m, 2H), 1.81-1.91 (m, 2H), 2.26-2.28 (m, 2H), 2.60-2.73 (m, 4H), 2.92 (s, 1H), 3.17 (s, 1H), 3.61-3.65 (m, 3H), 3.72 (s, 3H), 3.83 (m, 3H), 4.06 (q, J = 7.11 Hz, 2H), 4.38 (s, 3H), 4.48-4.52 (m, 2H), 5.76 (s, 1H), 6.81-6.85 (m, 2H), 6.91-6.95 (m, 2H), 7.00 (d, J = 2.01 Hz, 1H), 7.03 (d, J = 2.01 Hz, 2H), 7.07 (s, 1H), 7.10 (s, 1H), 7.18 (d, J = 2.01 Hz, 1H), 7.21 (d, J = 2.1 Hz, 1H); MS (ES) m/z: 707.0 (MH⁺); HRMS found for C₃₂H₄₂N₄O₁₀S₂: 707.2418.

EXAMPLE 340

Ethyl5-[(2S)-3-{[1-(4-{[(3,4-dimethoxyphenyl)sulfonyl]amino}phenyl)-4-piperidinyl]amino}-2-hydroxypropyl)oxy]-2-methyl-1H-indole-3-carboxylate

The title compound was prepared according to the procedure of Example 326 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.23 (m, 2H), 1.33 (t, J = 7.08 Hz, 3H), 1.84-1.91 (m, 2H), 2.58-2.66 (m, 3H), 2.61 (s, 3H), 2.72-2.89 (m, 2H), 3.47-3.53 (m, 2H), 3.71 (s, 3H), 3.78 (m, 3H), 3.87-3.96 (m, 4H), 4.22 (q, J = 7.08 Hz, 2H), 5.12 (brs, 3H), 6.74-6.82 (m, 3H), 6.88 (d, J = 9.0 Hz, 2H), 7.02 (d, J = 8.7 Hz, 1H), 7.16 (d, J = 2.1 Hz, 1H), 7.20-7.27 (m, 2H), 7.43 (d, J = 2.4 Hz, 1H), 9.62 (brs, 1H), 11.67 (s, 1H); MS (ES) m/z: 667.1 (MH⁺); HRMS found for C₃₄H₄₂N₄O₈S: 667.2797.

EXAMPLE 341

Ethyl 4-[(2S)-3-{[1-(4-{[(3,4-dimethoxyphenyl)sulfonyl]amino}phenyl)-4-piperidinyl]amino}-2-hydroxypropyl)oxy]-2-methyl-5-phenyl-1H-pyrrole-3-carboxylate

The title compound was prepared according to the procedure of Example 326 as a light grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.27 (t, J = 7.11 Hz, 3H), 1.34-1.39 (m, 2H), 1.83-1.91 (m, 2H), 2.42 (s, 3H), 2.57-2.69 (m, 4H), 2.72-2.76 (m, 1H), 2.75-2.86 (m, 2H), 3.52-3.63 (m, 2H), 3.72 (s, 3H), 3.78 (m, 3H), 3.85-3.91 (m, 2H), 4.18 (q, J = 7.11 Hz, 2H), 5.76 (s, 1H), 6.79 (d, J = 9.09 Hz, 2H), 6.89 (d, J = 9.03 Hz, 2H), 7.03 (d, J = 8.52 Hz, 1H), 7.13-7.24 (m, 3H), 7.29-7.38 (m, 2H), 7.76 (d, J = 7.47 Hz, 2H), 9.59 (brs, 1H), 11.3 (s, 1H); MS (ES) m/z: 693.1 (MH⁺); HRMS found for C₃₆H₄₄N₄O₈S: 693.2953.

EXAMPLE 342

Benzyl((butylsulfonyl)-4-{4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)-ethyl)amino]-1-piperidinyl}anilino)acetate

5 The title compound was prepared according to the procedure of Example 326 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.85 (t, J = 7.35 Hz, 3H), 1.14-1.40 (m, 4H), 1.58-1.69 (m, 4H), 1.83-1.91 (m, 2H), 2.60-2.78 (m, 8H), 2.92 (s, 3H), 3.05-3.17 (m, 2H), 3.63-3.67 (m, 2H), 4.49 (s, 3H), 5.12 (s, 2H), 5.25 (brs, 1H), 6.83 (d, J = 8.22 Hz, 1H), 6.90 (d, J = 9.06 Hz, 2H), 7.01 (dd, J = 1.95 Hz, 8.31 Hz, 2H), 7.18 (d, J = 1.95 Hz, 1H), 7.23 (d, J = 8.97 Hz, 2H), 7.22-7.39 (m, 4H); MS (ES) m/z: 689.1 (MH⁺); HRMS found for C₃₃H₄₄N₄O₈S₂: 689.2669.

EXAMPLE 343

15 [(Butylsulfonyl)-4-{4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)-amino]-1-piperidinyl}anilino)acetic acid

A mixture of 0.18 g of [(butane-1-sulfonyl)-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-phenyl)-amino]-acetic acid benzyl ester (which was obtained in Example 342) and 0.05 g of 10% palladium on carbon in 15 mL of methanol was shaken on a Parr hydrogenator at 25 psi overnight. The mixture was filtered
20 through a pad of celite and the filtrate was concentrated in vacuo, which afforded a beige solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.86 (t, J = 7.23 Hz, 3H), 1.29-1.41 (m, 2H), 1.48-1.51 (m, 2H), 1.54-1.73 (m, 2H), 1.92-2.09 (m, 2H), 2.57-2.64 (m, 2H), 2.79-2.87 (m, 2H), 2.94 (s, 3H), 3.00-3.07 (m, 4H), 3.16 (s, 2H), 3.20-3.26 (m, 2H), 3.64-3.75 (m, 2H), 4.02-4.04 (m, 2H), 4.77-4.81 (m, 1H), 6.84-6.91 (m, 3H), 7.06 (dd, J = 2.1 Hz, 8.4 Hz, 2H), 7.23 (d, J = 1.8 Hz, 1H),
25 7.34 (d, J = 9.00 Hz, 2H); MS (ES) m/z: 599.0 (MH⁺); HRMS found for C₂₆H₃₈N₄O₈S₂: 599.2202.

EXAMPLE 344

30 [(3,4-Dimethoxyphenyl)sulfonyl]-4-{4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino]-1-piperidinyl}anilino)acetic acid

The title compound was prepared according to the procedure of Example 255 as a grey solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.48-1.70 (m, 4H), 2.02-2.10 (m, 2H), 2.61-2.73 (s, 2H), 2.95 (s, 3H), 3.05-3.09 (m, 1H), 3.17 (s, 2H), 3.73 (s, 3H), 3.79 (m, 2H), 3.83 (s, 3H), 4.11 (brs, 1H), 4.26 (s, 1H), 4.81-4.84 (m, 1H), 6.19 (brs, 1H), 6.84-6.87 (m, 3H), 6.89 (s, 1H), 6.97 (d,

J = 9.0 Hz, 2H), 7.04-7.10 (m, 2H), 7.20 (dd, J = 2.1 Hz, 8.4 Hz, 1H), 7.25 (d, J = 2.1 Hz, 1H), 8.79 (brs, 1H), 10.17 (brs, 1H); MS (ES) m/z: 679.0 (MH⁺); HRMS found for C₃₀H₃₈N₄O₁₀S₂: 679.2126.

5 EXAMPLE 345

Ethyl ((butylsulfonyl)-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl) amino]-phenyl}-ethyl)amino]-1-piperidinyl}anilino)acetate

The title compound was prepared according to the procedure of Example 326 as a yellow solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.87 (t, J = 7.29 Hz, 3H), 1.14-1.20 (m, 4H), 1.30-1.43 (m, 4H), 1.60-1.70 (m, 2H), 1.84-1.91 (m, 2H), 2.60-2.78 (m, 6H), 3.11-3.16 (m, 2H), 3.32 (brs, 4H), 3.63-3.68 (m, 2H), 3.95-4.14 (m, 2H), 4.38 (s, 2H), 4.48-4.53 (m, 1H), 5.3 (brs, 1H), 6.82 (d, J = 8.4 Hz, 1H), 6.91 (d, J = 9.3 Hz, 2H), 7.01 (dd, J = 1.8 Hz, 8.1 Hz, 1H), 7.18 (d, J = 2.1 Hz, 1H), 7.25 (d, J = 9.0 Hz, 2H); MS (ES) m/z: 627.3 (MH⁺); HRMS found for C₂₈H₄₂N₄O₈S₂: 627.2503.

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EXAMPLE 346

4-{[3-Chloro-5-(trifluoromethyl)-2-pyridinyl]oxy}-N-[4-(4-{[(2S)-2-hydroxy-3-phenoxypropyl]-amino}-1-piperidinyl)phenyl]benzenesulfonamide

Example 346 illustrated a solution phase combinatorial methodology for preparing compounds of the present invention in matrix fashion. A 3X3 grid of 20mL Teflon lined screw cap vials was arranged. To each vial was added the amino ketone, the solvents, and the base, then one sulfonyl chloride per row, one aryloethanolamine or aryloxypropanolamine per column, was added according to the following detailed procedure: To a suspension of 1-(4-amino-phenyl)-4-piperidone hydrochloride (which was obtained in Example 224) (79 mg, 0.3 mmol) in 10 mL of THF/CH₂Cl₂ (1: 1) was added 4-(3-chloro-5-trifluoromethyl-2-pyridyloxy)benzenesulfonyl chloride (167mg, 0.45 mmol), triethylamine (0.1 mL), and (piperidinomethyl)polystyrene (462 mg, 2.6 mmol/g). The mixture was shaken for 1 day. Aminomethylated polystyrene resin (95 mg, 2.6 mmol/g) was added to the reaction along with 1 mL of CH₂Cl₂ and the reaction was continued for another day. The resins were removed by filtration and washed with CH₂Cl₂ (3 X 1 mL). The filtrate and washings were combined and concentrated to give 4-(3-chloro-5-trifluoromethyl-2-pyridyloxy)-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzenesulfonamide which was redissolved in 10 mL of trimethyl orthoformate/methanol (1 : 1). To the solution was added (2S)-1-amino-3-phenoxy-propan-2-ol (75 mg, 0.45 mmol). The mixture was shaken for 18 hours and then Amberlite IRA-400 borohydride resin (360 mg, 2.5 mmol/g) was added to the mixture and reaction was continued for 5 hours. To the mixture was then added

formylpolystyrene (1 g, 0.5 mmol/g) and 1 mL of CH₂Cl₂. The reaction was continued for 18 hours. The resins were removed by filtration and washing extensively with methanol and CH₂Cl₂. The filtrate and washings were combined and concentrated. The residue was purified by thin layer chromatography (12% MeOH/CH₂Cl₂) to give the title compound as a white solid;

¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.70-1.90 (m, 2 H), 2.50-2.80 (m, 5 H), 3.45-3.60 (m, 2 H), 3.80-4.00 (m, 3 H), 4.95 (brs, 1 H), 5.24 (brs, 1 H), 6.81 (d, J = 9.0 Hz, 2 H), 6.88 (d, J = 9.0 Hz, 2 H), 6.85-7.00 (m, 3 H), 7.25-7.35 (m, 2 H), 7.41 (d, J = 9.0 Hz, 2 H), 7.75 (d, J = 9.0 Hz, 2 H), 8.53 (d, J = 2.0 Hz, 1 H), 8.62 (d, J = 2.0 Hz, 1 H); MS (ES) m/z: 677.0 (MH⁺); HRMS Calcd. for C₃₂H₃₃F₃N₄O₅SCl (MH⁺): 677.1812. Found: 677.1816. Anal. Calcd. for C₃₂H₃₂F₃N₄O₅SCl: C, 56.70; H, 4.76; N, 8.27. Found: C, 56.58; H, 4.90; N, 8.03.

EXAMPLE 347

N-[(5-{[4-(4-{[(2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino}-1-piperidiny]anilino)sulfonyl}-2-thienyl)methyl]benzamide

The title compound was prepared from 1-(4-aminophenyl)-4-piperidone hydrochloride (which was obtained in Example 224), (2-benzoylaminomethyl)thiophene-5-sulphonyl chloride, and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356-1998) according to the procedure of Example 346; MS (ES) m/z: 677.4 (MH⁺).

EXAMPLE 348

N-[(5-{[4-(4-{[(2S)-2-Hydroxy-3-phenoxypropyl]amino}-1-piperidiny]anilino)sulfonyl}-2-thienyl)methyl]benzamide

The title compound was prepared from 1-(4-aminophenyl)-4-piperidone hydrochloride (which was obtained in Example 224), (2-benzoylaminomethyl)thiophene-5-sulphonyl chloride, and (2S)-1-amino-3-phenoxy-propan-2-ol according to the procedure of Example 346; MS (ES) m/z: 621.4 (MH⁺).

EXAMPLE 349

N-[(5-{[4-(4-{[2-Hydroxy-2-(3-hydroxyphenyl)ethyl]amino}-1-piperidiny]-anilino)sulfonyl}-2-thienyl)methyl]benzamide

The title compound was prepared from 1-(4-aminophenyl)-4-piperidone hydrochloride (which was obtained in Example 224), (2-benzoylaminomethyl)thiophene-5-sulphonyl chloride, and DL-norphenylephrine according to the procedure of Example 346; MS (ES) m/z: 607.4 (MH⁺).

EXAMPLE 350

4-([3-Chloro-5-(trifluoromethyl)-2-pyridinyl]oxy)-N-[4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino]-1-piperidinyl]phenyl]-benzenesulfonamide

The title compound was prepared from 1-(4-aminophenyl)-4-piperidone hydrochloride (which was obtained in Example 224), 4-(3-chloro-5-trifluoromethyl-2-pyridyloxy)benzenesulfonyl chloride, and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) according to the procedure of Example 346; MS (ES) m/z: 733.3 (MH⁺).

EXAMPLE 351

4-([3-Chloro-5-(trifluoromethyl)-2-pyridinyl]oxy)-N-[4-[4-([2-hydroxy-2-(3-hydroxyphenyl)ethyl]amino)-1-piperidinyl]phenyl]benzenesulfonamide

The title compound was prepared from 1-(4-aminophenyl)-4-piperidone hydrochloride (which was obtained in Example 224), 4-(3-chloro-5-trifluoromethyl-2-pyridyloxy)benzenesulfonyl chloride, and DL-norphenylephrine according to the procedure of Example 346; MS (ES) m/z: 663.2 (MH⁺).

EXAMPLE 352

3,5-Dichloro-4-(2-chloro-4-nitrophenoxy)-N-[4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl]-benzenesulfonamide

The title compound was prepared from 1-(4-aminophenyl)-4-piperidone hydrochloride (which was obtained in Example 224), 4-(2-chloro-4-nitrophenoxy)-3,5-dichlorobenzenesulfonyl chloride, and (S)-4-[2-hydroxy-3-aminopropoxy]-1,3-dihydro-2H-benzimidazol-2-one (US 5,786,356/1998) according to the procedure of Example 346; MS (ES) m/z: 777.2, 779.2 (MH⁺).

EXAMPLE 353

3,5-Dichloro-4-(2-chloro-4-nitrophenoxy)-N-[4-[4-((2S)-2-hydroxy-3-phenoxypropyl)amino]-1-piperidinyl]phenyl]benzenesulfonamide

The title compound was prepared from 1-(4-aminophenyl)-4-piperidone hydrochloride (which was obtained in Example 224), 4-(2-chloro-4-nitrophenoxy)-3,5-dichlorobenzenesulfonyl chloride, and (2S)-1-amino-3-phenoxy-propan-2-ol according to the procedure of Example 346; MS (ES) m/z: 723.2, 725.2 (MH⁺).

EXAMPLE 354

3,5-Dichloro-4-(2-chloro-4-nitrophenoxy)-N-[4-(4-[[2-hydroxy-2-(3-hydroxyphenyl)-ethyl]amino]-1-piperidiny]phenyl]benzenesulfonamide

The title compound was prepared from 1-(4-aminophenyl)-4-piperidone hydrochloride (which was obtained in Example 224), 4-(2-chloro-4-nitrophenoxy)-3,5-dichlorobenzenesulfonyl chloride, and DL-norphenylephrine according to the procedure of Example 346; MS (ES) m/z: 709.1, 711.1 (MH⁺).

EXAMPLE 355

N-[4-(4-[[2S)-2-Hydroxy-3-phenoxypropyl]amino]-1-piperidiny]phenyl]-2-thiophenesulfonamide

The title compound was prepared according to the procedure of Example 346 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.81-0.83 (m, 1H), 1.23-1.36 (m, 3H), 1.84-1.88 (m, 2H), 2.61-2.73 (m, 4H), 3.53 (d, J = 12.03 Hz, 3H), 3.95-4.04 (m, 2H), 5.02 (brs, 1H), 6.80 (d, J = 9.09 Hz, 1H), 6.89-6.94 (m, 6H), 7.08-7.11 (m, 2H), 7.24-7.30 (m, 1H), 7.40 (dd, J = 1.29 Hz, 5.01 Hz, 1H), 7.86 (dd, J = 1.29 Hz, 3.69 Hz, 1H); MS (ES) m/z: 488.0 (MH⁺); HRMS found for C₂₄H₂₉N₃O₄S₂: 488.1691.

EXAMPLE 356

4-Butoxy-N-[4-(4-[[2S)-2-hydroxy-3-phenoxypropyl]amino]-1-piperidiny]-phenyl]benzenesulfonamide:

The title compound was prepared according to the procedure of Example 346 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.91 (t, J = 7.32 Hz, 3H), 1.24-1.35 (m, 2H), 1.39-1.50 (m, 2H), 1.63-1.72 (m, 2H), 1.82-1.91 (m, 2H), 2.57-2.65 (m, 4H), 2.69-2.72 (m, 2H), 3.13-3.19 (m, 1H), 3.46-3.52 (m, 2H), 3.83-3.90 (m, 2H), 3.92-4.01 (m, 2H), 4.98 (brs, 1H), 5.21-5.25 (m, 1H), 6.76 (d, J = 9.09 Hz, 2 H), 6.85-6.95 (m, 2 H), 7.01 (d, J = 8.94 Hz, 2H), 7.24-7.31 (m, 4 H), 7.57 (d, J = 8.88 Hz, 2H), 8.04 (s, 1 H); MS (ES) m/z: 554.5 (MH⁺); HRMS found for C₃₀H₃₉N₃O₅S: 554.2685.

EXAMPLE 357

N-[4-(4-[[2S)-2-Hydroxy-2-(3-hydroxyphenyl)ethyl]amino]-1-piperidiny]phenyl]-2-thiophenesulfonamide

The title compound was prepared according to the procedure of Example 346 as a light green solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.81-0.90 (m, 1H), 1.24-1.35 (m, 2H), 1.87-1.91 (m, 2H), 2.59-2.73 (m, 4H), 3.40-3.47 (m, 2H), 3.53-3.57 (m, 2H), 4.53 (brs, 2H), 5.31 (brs,

1H), 6.62 (d, J = 7.68 Hz, 1 H), 6.75 (d, J = 8.64, 1H), 6.82 (d, J = 9.09, 3H), 6.92 (d, J = 8.97 Hz, 1 H), 7.07-7.12 (m, 2H), 7.41 (dd, J = 1.26 Hz, 3.75 Hz, 1H), 7.86 (dd, J = 1.14 Hz, 4.92 Hz, 1H), 9.29 (s, 1 H); MS (ES) m/z: 474.0 (MH⁺); HRMS found for C₂₃H₂₇N₃O₄S₂: 474.1522.

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EXAMPLE 358

4-Butoxy-N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino]-1-piperidiny]phenyl}benzenesulfonamide

The title compound was prepared according to the procedure of Example 346 as a brownish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.89-0.95 (m, 3H), 1.35-1.49 (m, 2H), 1.64-1.73 (m, 2H), 1.90-2.02 (m, 1H), 2.58-2.62 (m, 1 H), 2.90-3.05 (m, 1H), 3.13-3.16 (m, 1H), 3.62-3.66 (brd, 1H), 3.89-4.06 (m, 2H), 5.06-5.08 (d, J = 4.86 Hz, 1H), 5.48 (brs, 1H), 6.56-6.70 (m, 3H), 6.79-6.91 (m, 8 H), 7.01-7.04 (d, J = 8.91 Hz, 2H), 7.46-7.54 (m, 2H), 7.57-7.60 (dd, J = 1.83 Hz, 8.88 Hz, 2H) 8.04 (s, 1H), 8.16 (s, 1H), 9.66 (brs, 1H), 10.55-10.65 (m, 2H), 10.7 (s, 1 H); MS (ES) m/z: 610.4 (MH⁺); HRMS found for C₃₁H₃₉N₅O₆S: 610.2707.

EXAMPLE 359

N-{4-[4-((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl)amino]-1-piperidiny]phenyl}-3,4-dimethoxybenzenesulfonamide

The title compound was prepared according to the procedure of Example 346 as a gray solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.49-1.55 (m, 2H), 1.99-2.17 (m, 2H), 2.58-2.65 (m, 2H), 2.85-2.98 (m, 2H), 3.07-3.09 (m, 2H), 3.59-3.63 (m, 2H), 3.72 (s, 3H), 3.78 (s, 3H), 4.01 (s, 3H), 5.35 (brs, 1H), 6.57-6.64 (m, 2H), 6.79-6.92 (m, 5H), 7.018-7.046 (d, J = 8.4 Hz, 1H), 7.18-7.25 (m, 2H), 8.18 (s, 1H), 9.62 (brs, 1H), 10.61 (s, 1H), 10.72 (s, 1H); MS (ES) m/z: 598.1 (MH⁺); HRMS found for C₂₉H₃₅N₅O₇S: 598.2348.

EXAMPLE 360

N-[4-(4-((2S)-2-Hydroxy-3-phenoxypropyl)amino)-1-piperidiny]phenyl]-3,4-dimethoxybenzenesulfonamide

The title compound was prepared according to the procedure of Example 346 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.85-0.90 (m, 1H), 1.24-1.51 (m, 2H), 1.82-1.90 (m, 2H), 2.58-2.70 (m, 4H), 3.48-3.52 (m, 2H), 3.71 (s, 3H), 3.78 (s, 3H), 3.84-3.92 (m, 2H), 4.99 (brs, 1H), 5.23-5.25 (m, 1H), 6.76 (s, 1H), 6.79 (s, 1H), 6.86-6.94 (m, 2H), 7.01 (s, 1H),

7.04 (s, 1H), 7.16 (d, J = 2.13 Hz, 2H), 7.20-7.21 (d, J = 2.1 Hz, 1H), 7.23-7.24 (m, 1H), 7.26-7.29 (m, 2H), 7.66-7.72 (m, 1H), 8.08 (s, 1H), 9.56 (brs, 1H); MS (ES) m/z: 542.1 (MH⁺); HRMS found for C₂₈H₃₅N₃O₆S: 542.2330.

5 EXAMPLE 361

N-[4-(4-{[2-Hydroxy-2-(3-hydroxyphenyl)ethyl]amino}-1-piperidiny]phenyl]-3,4-dimethoxybenzenesulfonamide

The title compound was prepared according to the procedure of Example 346 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.35-1.40 (m, 2H), 1.64 (m, 1H), 1.85-1.95 (m, 2H), 2.72-2.73 (m, 2H), 2.80 (m, 2H), 3.52-3.57 (m, 2H), 3.71 (s, 3H), 3.78 (s, 3H), 4.58 (m, 1H), 5.55 (brs, 1H), 6.62-6.65 (m, 1H), 6.74-6.81 (m, 3H), 6.89 (d, J = 9.0 Hz, 1H), 7.01 (s, 1H), 7.04 (s, 1H), 7.08-7.14 (m, 1H), 7.17 (d, J = 8.01 Hz, 1H), 7.21 (d, J = 2.13 Hz, 1H), 7.24 (d, J = 2.07 Hz, 1H), 9.34 (s, 1H), 9.55 (brs, 1H); MS (ES) m/z: 528.1 (MH⁺); HRMS found for C₂₇H₃₃N₃O₆S: 528.2160.

15 EXAMPLE 362

N-{4-[4-((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino)-1-piperidiny]phenyl}-2-thiophenesulfonamide

The title compound was prepared according to the procedure of Example 346 as a greenish solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.38 (m, 2H), 1.91 (m, 2H), 2.64 (t, 2H), 2.75 (m, 2H), 2.85 (m, 2H), 3.15 (d, 1H), 3.55 (m, 2H), 3.93-3.96 (m, 2H), 5.05 (brs, 1H), 6.57 (d, J = 5.7 Hz, 1H), 6.61 (d, J = 6.3 Hz, 1H), 6.81-6.87 (m, 2H), 6.92 (d, J = 6.9 Hz, 1H), 7.10 (t, J = 3.6 Hz, 1 H), 7.41(d, J = 2.1 Hz, 1H), 7.86 (d, J = 3.6 Hz, 1H), 10.6 (s, 1H), 10.7 (s, 1H); MS (ES) m/z: 544.0 (MH⁺); HRMS found for C₂₅H₂₉N₅O₅S₂ : 544.1709.

25 EXAMPLE 363

Ethyl 3-oxo-3-[4-(4-oxo-1-piperidiny]anilino]propanoate

To a stirred solution, under N₂ atmosphere, of 1-(4-amino-phenyl)-piperidin-4-one hydrochloride (which was obtained in Example 224)(10.0 g, 38 mmol), and triethylamine (15.35 g, 150 mmol) in methylene chloride (100 mL) was added ethyl 3-chloro-3-oxopropionate (6.32 g, 42 mmol). The reaction was stirred for 18 hours. The reaction mixture was concentrated down in vacuo and purified by flash silica gel chromatography eluting with 1:1 ethyl acetate / hexanes to give an orange solid (0.86 g, 7%); ¹H NMR (300 MHz, CDCl₃) δ 1.32 (t, J = 7.2 Hz, 3 H), 2.55 (t, J = 6 Hz, 4 H), 3.46 (s, 2 H), 3.56 (t, J = 6 Hz, 4 H), 4.22 (q, J = 7.2 Hz, 2 H),

6.93(d, J = 9.0 Hz, 2 H), 7.47(d, J = 9.0 Hz, 2 H), 9.09 (s, 1 H); MS (ES) m/z: 305.3(MH⁺, 100%).

EXAMPLE 364

5 Ethyl 3-[butyl-4-(4-oxo-1-piperidiny)anilino]-3-oxopropanoate

A solution of 8-(4-nitro-phenyl)-1,4-dioxo-8-aza-spiro[4.5]decane (13.01 g, 49 mmol) was hydrogenated under 45 psi for one hour using 10% palladium on carbon (2.5 g) as catalyst. The reaction mixture was filtered through celite pad and the filtrate was concentrated down to give a white solid (11.46 g, 100%). This material was taken onto next step immediately. To a stirred mixture, under N₂ atmosphere, of the aniline (11.46 g, 49 mmol), butryaldehyde (4.43 mL, 49 mmol) in tetrahydrofuran (250 mL) was added sodium triacetoxyborohydride (14.62 g, 68.6 mmol), and glacial acetic acid (2.82 mL, 49 mmol). The reaction was stirred for two hours. The reaction was quenched with 1 N NaOH (50 mL), diluted with water, extracted with ether 3 times and dried over sodium sulfate. The product was purified by flash silica gel chromatography eluting with 1:1 ethyl acetate / hexanes to give an oil (5.80g, 41%). This material was immediately taken onto next step. A solution of the N-butyl aniline (5.80 g, 19.9 mmol) in a 1:1 mixture of perchloric acid and hydrochloric acid (100 mL) was stirred at room temperature for three days. The reaction mixture was poured onto ice and made basic with concentrated ammonium hydroxide, extracted with ether four times, dried over sodium sulfate and concentrated to give a yellow oil. The yellowish oil was purified by flash silica gel chromatography eluting with 1:1 ethyl acetate / hexanes to give 1-[4-(butylamino)phenyl]-4-piperidinone as an oil (3.84 g, 82%). To a stirred mixture of 1-[4-(butylamino)phenyl]-4-piperidinone (2.46 g, 10 mmol), triethylamine (1.81 mL, 13 mmol), and 4-(dimethylamino)pyridine (DMAP) (catalytic amount) was added ethyl 3-chloro-3-oxopropionate (2.18 g, 13 mmol) dropwise. The reaction was stirred for 18 hours. The reaction mixture was filtered, concentrated in vacuo, taken up in methylene chloride, and washed with saturated sodium bicarbonate two times and dried over sodium sulfate. The product was purified by flash silica gel chromatography eluting with 1:1 ethyl acetate / hexanes to give a yellow oil (3.84 g, 68%); MS (ES) m/z: 361.3(MH⁺, 100%).

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EXAMPLE 365

3-[Cyclohexyl-4-(4-oxo-1-piperidiny)anilino]-3-oxopropanoic acid

A solution of 8-(4-nitro-phenyl)-1,4-dioxo-8-aza-spiro[4.5]decane (13.01 g, 49 mmol) was hydrogenated under 45psi for one hour using 10% palladium on carbon (2.5 g) as catalyst. The reaction mixture was filtered through celite pad and the filtrate was concentrated down to give a white solid (11.46 g, 100%). This material was taken onto next step immediately. To a

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stirred mixture, under N₂ atmosphere, of the aniline (10.99 g, 47 mmol), cyclohexanone (4.90 mL, 47 mmol) in tetrahydrofuran (250 mL) was added sodium triacetoxymethylborohydride (14.05 g, 66 mmol), and glacial acetic acid (2.71 mL, 47 mmol). The reaction was stirred for one hour. The reaction was quenched with 1 N NaOH (50 mL), diluted with water, extracted with ether 3 times and dried over sodium sulfate. The product was isolated as an oil (14.85 g, 100%). This material was immediately taken onto next step without further purification. A solution of N-cyclohexyl aniline (14.85 g, 47 mmol) in hydrochloric acid (100 mL) was stirred at room temperature for 18 hours. The reaction mixture was poured onto ice and made basic with concentrated ammonium hydroxide, extracted with ether four times, dried over sodium sulfate and concentrated to give a yellow oil. The product was used without further purification (12.78 g, 100%). To a stirred mixture of the ketone (12.78 g, 47 mmol), triethylamine (8.49 mL, 61 mmol), and DMAP (catalytic amount) was added ethyl 3-chloro-3-oxopropionate (9.19 g, 61 mmol) dropwise. The reaction was stirred for 18 hours. The reaction mixture was filtered and concentrated in vacuo to give an oil (3.48 g, 19%).

To a stirred solution of 1N sodium hydroxide (6 mL) was added the oil (3.11g, 8.1 mmol). The reaction was stirred for 18 hours. The reaction mixture was brought to a pH of 6 with acetic acid, extracted with ethyl acetate, and dried over sodium sulfate. The product was purified by flash chromatography on reverse phase silica gel eluting 70:30 methanol / water to give a yellow solid (1.36 g, 47%). MS (ES) m/z: 359.2 (MH⁺, 100%); HRMS Calcd. for C₂₀H₂₆N₂O₄(2M-H)⁻: 715.3711. Found: 715.3707.

EXAMPLE 366

{3-[4-(4-Oxo-piperidin-1-yl)-phenyl]-ureido}-acetic acid ethyl ester

Isocyanatoacetate (1.76g, 13.6 mmol) in 10 mL of methylene chloride was added dropwise to a stirred solution of 1-(4-amino-phenyl)-piperidin-4-one (2.60g, 13.6 mmol)(which was obtained in Example 224) in 100 mL of methylene chloride at room temperature. After stirring for 3 hours the solvent was removed and the residue was washed with hexanes to give the title compound as a pale brown solid (2.0g, 46%); ¹H NMR (300 MHz, DMSO-d₆) δ 1.20(t, J = 7.1 Hz, 3 H), 2.41 (t, J = 6.0 Hz, 4 H), 3.48 (t, J = 6.0 Hz, 4 H), 3.83 (d, J = 5.8 Hz, 2 H); 4.10 (q, J = 7.1 Hz, 2 H), 6.31(t, J = 5.8 Hz, 2 H), 6.94(d, J = 9.0 Hz, 2 H), 7.26 (d, J = 9.0 Hz, 1 H), 8.52(s, 1 H); MS (ES) m/z: 320.5 (MH⁺); HRMS Calcd. for C₂₀H₂₈N₂O₄(M⁺): 319.1532. Found: 319.1540.

EXAMPLE 367Ethyl ({[butyl-4-(4-oxo-1-piperidinyl)anilino]carbonyl}amino)acetate

The title compound was prepared from ethyl isocyanatoacetate and 1-[4-(butylamino)-phenyl]-4-piperidinone (which was obtained in Example 364) according to the procedure of Example 366 as a pale brown solid; MS (ES) m/z: 376.5 (MH⁺).

EXAMPLE 368N-[4-(4-Oxo-piperidin-1-yl)-phenyl]-butyramide

Butyryl chloride (0.31mL, 2.94mmol) was added to a solution of N-[4-(4-oxo-piperidin-1-yl)-phenyl]amine (which was obtained in Example 224) (0.70g, 2.77mmol) and triethylamine (1.9mL, 13.9mmol) in anhydrous methylene chloride (10mL). The reaction was stirred overnight. The reaction was quenched with water (50mL) and washed with methylene chloride (3x20mL). The organic extracts were combined, dried (sodium sulfate) and concentrated. The desired product was isolated using silica gel flash chromatography to give the title compound as a yellow solid (0.41 g); ¹H NMR (300 MHz, CDCl₃) δ 1.01 (t, 3H, J = 7.38Hz), 1.72 (m, 2H), 2.29(t, 2H, J = 7.62Hz), 2.55(t, 4H, J = 6.03Hz), 3.55(t, 4H, J = 5.97Hz), 6.95(d, 2H, J = 7.91), 7.42(d, 2H, J = 8.97Hz). MS (ES) m/z: 260.9(MH⁺); HRMS found for C₁₅H₂₀N₂O₂: 260.1511. Anal. Calcd. for C, 69.20; H, 7.74, N, 10.76. Found: C, 69.03; H, 7.94; N, 10.59.

EXAMPLE 3693,4-Dimethoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzamide

The title compound was prepared according to the procedure of Example 368 as an off-white solid; ¹H NMR (300 MHz, CDCl₃) δ 2.42(t, 4H, J = 5.94Hz), 3.56(t, 4H, J = 6.03Hz), 3.81(s, 3H), 3.84(s, 3H), 7.05(m, 3H), 7.52(d, 1H, 2.10Hz), 7.62(m, 3H), 9.97(s, 1H). MS (ES) m/z: 355.0(MH⁺); HRMS found for C₂₀H₂₂N₂O₄: 354.1577.

EXAMPLE 3702-Chloro-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-acetamide

The title compound was prepared according to the procedure of Example 368 as a dark blue solid; ¹H NMR (300 MHz, CDCl₃) δ 2.55(t, 4H, J = 5.88Hz), 3.58(t, 4H, J = 5.91Hz), 4.19(s, 2H), 6.97(d, 2H, J = 8.67Hz), 7.47(d, 2H, 8.94Hz), 8.17(brs, 1H). MS (ES) m/z: 266.8(MH⁺); HRMS found for C₁₃H₁₅N₂O₂: 266.0805.

EXAMPLE 371

Ethyl 3-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)-amino]-1-piperidinyl}anilino)-3-oxopropanoate:

To a stirred solution of N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10)(0.3g, 1.2mmol) and ethyl 3-oxo-3-[4-(4-oxo-1-piperidinyl)anilino]propanoate (which was obtained in Example 363) (0.39g, 1.28mmol) in dimethylformamide (8mL) under nitrogen atmosphere was added sodium triacetoxymethylborohydride (0.34g, 1.59mmol) and glacial acetic acid (0.08g, 1.3mmol). The mixture was stirred at room temperature for 3 days. The reaction was quenched with saturated sodium bicarbonate, extracted with ethyl acetate three times, dried over sodium sulfate, and concentrated. The product was purified by flash silica gel chromatography eluting with 20% methanol in methylene chloride to give the title compound as a yellow solid (0.23g, 36%); ¹H NMR (300 MHz, DMSO-d₆) δ 1.19(t, J = 7.0 Hz, 3 H), 1.25-1.45 (m, 2 H), 1.75-1.95 (m, 2 H), 2.50-2.70 (m, 5 H), 2.92 (s, 3 H), 3.33(s, 2 H), 3.45-3.60 (m, 2 H), 4.09(q, J = 7.0 Hz, 2 H), 4.48(dd, J = 8.1, 4.2 Hz, 1 H), 6.80(d, J = 8.3 Hz, 1 H), 6.90(d, J = 9.0 Hz, 2 H), 7.00(dd, J = 8.3, 2.0 Hz, 1 H), 7.18 (d, J = 2.0 Hz, 1 H), 7.39(d, J = 9.0 Hz, 2 H), 9.92(s, 1 H); MS (ES) m/z: 535.3 (MH⁺); HRMS Calcd. for C₂₅H₃₅N₄O₇S (MH⁺): 535.2221. Found: 535.2208.

EXAMPLE 372

3-(4-{4-[(2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)-3-oxopropanoic acid

To a stirred solution of ethyl 3-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)-3-oxopropanoate (which was obtained in Example 371)(0.23 g, 0.43 mmol) in distilled water (3 mL) and ethanol (2 mL) was added 1 N sodium hydroxide (2 mL). The reaction was stirred at room temperature for 1 hr. The reaction mixture was made acidic (pH 6) with glacial acetic acid, concentrated, triturated with water, ether, ethyl acetate to give the title compound as a light yellow solid (0.13 g, 59%); ¹H NMR (300 MHz, DMSO-d₆) δ 1.30-1.45(m, 2 H), 1.80-1.95 (m, 2 H), 2.50-2.80 (m, 5 H), 2.90 (s, 2 H), 2.91(s, 3 H), 3.45-3.60 (m, 2 H), 4.48-4.53(m, 1 H), 6.80-6.90(m, 3H), 7.00(d, J = 8.3 Hz, 1 H), 7.18 (d, J = 1.6 Hz, 1 H), 7.38(d, J = 9.0 Hz, 2 H), 11.50-11.60(m, 1 H); MS (ES) m/z: 505.3 (M-H)⁻; HRMS Calcd. for C₂₃H₃₁N₄O₇S (MH⁺): 507.1908. Found: 507.1895.

EXAMPLE 373

Ethyl 3-(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino] phenyl}-ethyl)-amino]-1-piperidiny}anilino)-3-oxopropanoate

To a stirred solution, under nitrogen atmosphere, of N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) (0.85 g, 3.5 mmol) and ethyl 3-[butyl-4-(4-oxo-1-piperidiny)anilino]-3-oxopropanoate (which was obtained in Example 364) (1.47 g, 3.7 mmol) in methylene chloride (15 mL), dimethylformamide (5 mL) was added trimethyl orthoformate (1.53 mL, 14.0 mmol). The mixture was stirred for 2 hours before sodium triacetoxyborohydride (1.04 g, 4.9 mmol) and glacial acetic acid (0.2 mL, 3.5 mmol) was added. The reaction was stirred for 18 hours at room temperature. The reaction mixture was poured onto 1:1 water/ saturated sodium bicarbonate, extracted with 10% methanol in methylene chloride, dried over sodium sulfate, and concentrated. The product was purified by flash chromatography on normal phase silica gel eluting with 10% methanol in methylene chloride, then with 15% methanol in methylene chloride, and then flash chromatograph on reverse phase silica gel eluting with methanol to give the titled compound as a tan solid (0.6g, 29%); ¹H NMR (300 MHz, DMSO-d₆) δ 0.81(t, J = 7.0 Hz, 3 H), 1.11(t, J = 7.0 Hz, 3 H), 1.20-1.50(m, 6 H), 1.80-2.00 (m, 2 H), 2.65-2.90 (m, 5 H), 2.93 (s, 3 H), 3.09(s, 2 H), 3.56(t, J = 6.8 Hz, 2 H), 3.65-3.80 (m, 2 H), 3.97(q, J = 7.0 Hz, 2 H), 4.55-4.65(m, 1 H), 6.85(d, J = 8.3 Hz, 1 H), 6.96(d, J = 9.0 Hz, 2 H), 7.00-7.10(m, 3 H), 7.20 (d, J = 2.0 Hz, 1 H); MS (ES) m/z: 591.2(MH⁺); HRMS Calcd. for C₂₉H₄₂N₄O₇S(M⁺): 590.2774. Found: 590.2847.

EXAMPLE 374

3-(Butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidiny}anilino)-3-oxopropanoic acid

To a stirred solution of ethyl 3-(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-yl}ethyl)-amino]-1-piperidiny}anilino)-3-oxopropanoate (which was obtained in Example 373) (0.23 g, 0.39 mmol) in distilled water (3 mL) and ethanol (2 mL) was added 1 N sodium hydroxide (2 mL). The reaction was stirred at room temperature for 1 hour. The mixture was acidified (pH 6) with glacial acetic acid, concentrated, triturated with water, ethyl acetate, ether, and dried under vacuum to give the titled compound as a tan solid (0.04 g, 19%); ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.50(m, 6 H), 1.70-1.95 (m, 2 H), 2.60-2.80 (m, 5 H), 2.83 (s, 2 H), 2.91(s, 3 H), 3.45-3.70 (m, 4 H), 4.55-4.65(m, 1 H), 6.81(d, J = 8.0 Hz, 1 H), 6.90(d, J = 8.7 Hz, 2 H), 7.09 (d, J = 8.7 Hz, 2 H), 7.07(s, 1 H); MS (ES) m/z: 563.2(MH⁺); HRMS Calcd. for C₂₇H₃₉N₄O₇S(MH⁺): 563.2461. Found: 563.2526.

EXAMPLE 375

Ethyl 3-(cyclohexyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]-phenyl}ethyl)-amino]-1-piperidiny}anilino)-3-oxopropanoate

A solution of 8-(4-nitro-phenyl)-1,4-dioxo-8-aza-spiro[4.5]decane (13.01 g, 49 mmol) was hydrogenated under 45psi for one hour using 10% palladium on carbon (2.5 g) as catalyst. The reaction mixture was filtered through celite pad and the filtrate was concentrated down to give a white solid (11.46 g, 100%). This material was taken onto next step immediately. To a stirred mixture, under N₂ atmosphere, of the aniline (10.99 g, 47 mmol), cyclohexanone (4.90 mL, 47 mmol) in tetrahydrofuran (250 mL) was added sodium triacetoxymethylborohydride (14.05 g, 66 mmol), and glacial acetic acid (2.71 mL, 47 mmol). The reaction was stirred for one hour. The reaction was quenched with 1 N NaOH (50 mL), diluted with water, extracted with ether 3 times and dried over sodium sulfate. The product was isolated as an oil (14.85 g, 100%). This material was immediately taken onto next step without further purification. A solution of the N-cyclohexyl aniline (14.85 g, 47 mmol) in hydrochloric acid (100 mL) was stirred at room temperature for 18 hours. The reaction mixture was poured onto ice and made basic with concentrated ammonium hydroxide, extracted with ether four times, dried over sodium sulfate and concentrated to give a yellow oil. The product was used without further purification (12.78 g, 100%). To a stirred mixture of the ketone (12.78 g, 47 mmol), triethylamine (8.49 mL, 61 mmol), and DMAP (catalytic amount) was added ethyl 3-chloro-3-oxopropionate (9.19 g, 61 mmol) dropwise. The reaction was stirred for 18 hours. The reaction mixture was filtered and concentrated in vacuo to give an oil (3.48 g, 19%).

To a stirred solution, under nitrogen atmosphere, of N-[5-((1R)-2-amino-1-hydroxyethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) (0.20 g, 0.81 mmol) and the oil (0.37 g, 0.81 mmol) in methylene chloride (10 mL), dimethylformamide (2 mL) was added trimethyl orthoformate (0.35 mL, 3.2 mmol). The mixture was stirred for 18 hours before sodium triacetoxymethylborohydride (0.24 g, 1.1 mmol) and glacial acetic acid (0.047 mL, 0.81 mmol) were added. The mixture was stirred an additional 24 hours. The mixture was poured onto 1:1 water/ saturated sodium bicarbonate, extracted with 10% methanol in methylene chloride, dried over sodium sulfate, and concentrated. The product was purified by flash chromatography on normal phase silica gel eluting with 15% methanol in methylene chloride, and then flash chromatographed on reverse phase silica gel eluting with methanol to give the title compound as a tan solid (0.12 g, 24%); ¹H NMR (300 MHz, DMSO-d₆) δ 0.60-1.00(m, 4 H), 1.11(t, J = 7.0 Hz, 3 H), 1.15-1.80(m, 8 H), 1.80-2.00 (m, 2 H), 2.65-2.80 (m, 5 H), 2.93 (s, 3 H), 2.97(s, 2 H), 3.65-3.80 (m, 2 H), 3.97(q, J = 7.0 Hz, 2 H), 4.25-4.40(m, 1 H), 4.50-4.60(m, 1 H), 6.85(d, J = 8.3 Hz, 1 H), 6.90-7.00(m, 4 H), 7.03(dd, J = 8.3, 2.0 Hz, 1

H), 7.20 (d, J = 2.0 Hz, 1 H); MS (ES) m/z: 617.2(MH⁺); HRMS Calcd. for C₃₁H₄₄N₄O₇S(M⁺): 616.2932. Found: 617.3001.

EXAMPLE 376

5 3-(Cyclohexyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino] phenyl}-ethyl)-amino]-1-piperidinyl}anilino)-3-oxopropanoic acid

A mixture of N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) (0.28 g, 1.1 mmol), 3-[cyclohexyl-4-(4-oxo-1-piperidinyl)anilino]-3-oxopropanoic acid (which was obtained in Example 365) (0.41 g, 1.1 mmol), glacial acetic acid (1 mL), and 10% palladium on carbon in anhydrous methanol (75 mL) was hydrogenated under 20 psi for 18 hours. The mixture was filtered through celite. The filtrate was concentrated. The product was triturated with hot ether, and then with methanol to give the title compound as a tan solid (0.03 g, 4.6%); ¹H NMR (300 MHz, DMSO-d₆) δ 0.80-1.05(m, 4 H), 1.15-1.60(m, 4 H), 1.60-1.75(m, 4 H), 1.90-2.05 (m, 2 H), 2.65-2.90 (m, 5 H), 2.83 (s, 2 H), 2.93(s, 3 H), 3.65-3.80 (m, 2 H), 4.30-4.45(m, 1 H), 4.60-4.70(m, 1 H), 6.85(d, J = 8.3 Hz, 1 H), 6.95(d, J = 9.1 Hz, 2 H), 7.02(d, J = 9.1 Hz, 2 H), 7.05 (d, J = 8.3 Hz, 1 H), 7.22(s, 1 H); MS (ES) m/z: 587.3(M-H)⁻; HRMS Calcd. for C₂₉H₄₁N₄O₇S(M⁺+ H): 589.2690. Found: 589.2690.

20 EXAMPLE 377

Ethyl {[4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}anilino)carbonyl}amino}acetate

The title compound was prepared from {3-[4-(4-oxo-piperidin-1-yl)-phenyl]-ureido}-acetic acid ethyl ester (which was obtained in Example 366) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 278 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20 (t, J = 7.1 Hz, 3 H), 1.20-1.40 (m, 2 H), 1.80-1.95 (m, 2 H), 2.50-2.70 (m, 5 H), 2.92 (s, 3 H), 3.40-3.50 (m, 2 H), 3.83 (d, J = 5.9 Hz, 2 H), 4.10 (q, J = 7.1 Hz, 2 H), 4.47 (dd, J = 8.0, 4.3 Hz, 1 H), 6.28 (t, J = 5.9 Hz, 1 H), 6.75-6.85 (m, 3 H), 7.00 (dd, J = 8.3, 2.0 Hz, 1 H), 7.15-7.25 (m, 3 H), 8.45 (s, 1 H); MS (ES) m/z: 550.5 (MH⁺); HRMS Calcd. for C₂₅H₃₆N₅O₇S (MH⁺): 550.2330. Found: 550.2319.

EXAMPLE 378

{[(4-{4-[(2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl} ethyl)amino]-1-piperidinyl}anilino)carbonyl]amino}acetic acid

The title compound was prepared from ethyl {[4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)carbonyl]-amino}acetate (which was obtained in Example 377) by NaOH hydrolysis as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.35-1.55 (m, 2 H), 1.80-2.00 (m, 2 H), 2.50-2.90 (m, 5 H), 2.92 (s, 3 H), 3.30-3.50 (m, 2 H), 3.59 (d, J = 5.9 Hz, 2 H), 4.60 (dd, J = 8.8, 3.5 Hz, 1 H), 6.14 (t, J = 5.0 Hz, 1 H), 6.80 (d, J = 9.1 Hz, 2 H), 6.84 (d, J = 8.3 Hz, 1 H), 7.03 (dd, J = 8.3, 2.0 Hz, 1 H), 7.15-7.25 (m, 3 H), 8.54 (s, 1 H); MS (ES) m/z: 520.3 (M-H)⁻; HRMS Calcd. for C₂₃H₃₂N₅O₇S (MH⁺): 522.2017. Found: 522.2000.

EXAMPLE 379

Ethyl {[4-(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)-amino]-1-piperidinyl}anilino)carbonyl]amino}acetate

The title compound was prepared from ethyl {[4-(4-oxo-1-piperidinyl)anilino]carbonyl]amino}acetate (which was obtained in Example 367) and N-[5-((1R)-2-amino-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide (which was obtained in Example 10) according to the procedure of Example 278 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.83 (t, J = 7.1 Hz, 3 H), 1.17 (t, J = 7.1 Hz, 3 H), 1.15-1.40 (m, 6 H), 1.80-1.95 (m, 2 H), 2.50-2.80 (m, 5 H), 2.90 (s, 3 H), 3.49 (t, J = 6.9 Hz, 2 H), 3.55-3.60 (m, 2 H), 3.65 (d, J = 5.9 Hz, 2 H), 4.04 (q, J = 7.1 Hz, 2 H), 4.48 (dd, J = 7.9, 4.4 Hz, 1 H), 5.60 (t, J = 5.9 Hz, 1 H), 6.80 (d, J = 8.2 Hz, 1 H), 6.90-7.10 (m, 5 H), 7.17 (d, J = 2.0 Hz, 1 H); MS (ES) m/z: 606.3 (MH⁺); HRMS Calcd. for C₂₉H₄₄N₅O₇S (MH⁺): 606.2956. Found: 606.2955.

EXAMPLE 380

{[(Butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl} ethyl)-amino]-1-piperidinyl}anilino)carbonyl]amino}acetic acid

The title compound was prepared from ethyl {[4-(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)carbonyl]amino}acetate (which was obtained in Example 379) by NaOH hydrolysis as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 0.83 (t, J = 7.1 Hz, 3 H), 1.15-1.60 (m, 6 H), 1.85-2.00 (m, 2 H), 2.65-2.95 (m, 5 H), 2.92 (s, 3 H), 3.42 (d, J = 4.0 Hz, 2 H), 3.45-3.55 (m, 2 H), 3.65-3.80 (m, 2 H), 4.65-4.75 (m, 1 H), 5.16 (t, J = 4.0 Hz, 1 H), 6.83 (d, J = 8.3 Hz, 1 H), 6.95-7.15 (m, 5 H), 7.20 (d, J = 2.0

Hz, 1 H); MS (ES) m/z: 576.3 (M-H)⁻; HRMS Calcd. for C₂₇H₃₈N₅O₇S (M-H)⁻: 576.2497. Found: 576.2502.

EXAMPLE 381

5 N-[4-[4-((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino)-1-piperidinyl]phenyl]-3,4-dimethoxybenzamide

Sodium triacetoxymethylborohydride (0.044g, 2.1mmol) was added to a solution of 4-((2S)-3-amino-2-hydroxy-propoxy)-1,3-dihydro-benzimidazol-2-one (US 5,786,356) (0.23g, 1.05mmol), 3,4-dimethoxy-N-[4-(4-oxo-piperidin-1-yl)-phenyl]-benzamide (which was obtained
10 in Example 369) (0.41g, 1.16mmol), and acetic acid(0.07mL, 1.16mmol) in anhydrous dimethylformamide(8mL). The reaction was stirred for 2 hours. The reaction was quenched with 50% water/saturated aqueous NaHCO₃(20mL). The solids were captured on a filter and washed with ethyl acetate, diethyl ether, and hexanes to afford 0.31g of the desired product as a brown solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.32 (m, 2H), 1.89 (m, 2H), 2.54 (m, 1H), 2.65
15 (m, 2H), 2.84(m, 2H), 3.56 (m, 2H), 3.83(s, 3H), 3.84 (s, 3H), 3.95 (m, 2H), 4.02 (s, 1H), 5.06(brs, 1H), 6.52 (d, 1H, J = 7.1), 6.51(d, 1H, J = 8.1Hz), 6.88 (m, 2H), 7.08 (d, 1H, J = 8.7 Hz), 7.58 (m, 5H), 8.87 (s, 1H), 10.59 (brs, 1H), 10.72 (brs, 1H); MS (ES) m/z: 561.2 (MH⁺).

EXAMPLE 382

20 2-Chloro-N-[4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino)-1-piperidinyl]phenyl]acetamide

The title compound was prepared according to the procedure of Example 381 as a tan solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.31(m, 2H), 1.88 (m, 2H), 2.56 (m, 1H), 2.67 (m, 2H), 2.79(m, 2H), 3.54 (m, 2H), 3.95(s, 2H), 4.06 (m, 1H), 4.19 (s, 2H), 4.91(brs, 1H), 6.56 (d, 1H, J = 7.8), 6.64(d, 1H, J = 8.1Hz), 6.88 (m, 3H), 7.39 (d, 2H, J = 9.0 Hz), 10.06 (s, 1H); MS (ES)
25 m/z: 474.0 (MH⁺); HRMS found for C₂₃H₂₈ Cl N₅O₄: 474.1934.

EXAMPLE 383

30 N-[4-[4-((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino)-1-piperidinyl]phenyl]-2-(4-morpholinyl)acetamide

The title compound was prepared according to the procedure of Example 381 as a yellow solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.35(m, 2H), 1.88 (m, 2H), 2.61 (m, 2H), 2.69 (m, 2H), 2.79(m, 2H), 3.07(s, 2H), 3.48(m, 4H), 3.64(t, 4H, J = 4.23), 3.96(m, 3H), 5.11(brs,

1H), 6.58 (d, 1H, J = 7.8), 6.64(d, 1H, J = 8.4Hz), 6.85(m, 3H), 7.46(d, 2H, J = 8.7 Hz), 9.47(s, 1H); MS (ES)m/z: 525.1 (MH⁺); HRMS found for C₂₇H₃₆N₆O₅: 524.2719.

EXAMPLE 384

5 2-(Dimethylamino)-N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl)amino]-1-piperidinyl}phenyl}acetamide

The title compound was prepared according to the procedure of Example 381 as a dark brown solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.36(m, 2H), 1.89 (m, 2H), 2.27(s, 6H), 2.61 (m, 2H), 2.79(m, 2H), 3.00(s, 2H), 3.36(m, 1H), 3.54(m, 2H), 3.96(m, 3H), 4.98(bris, 1H), 6.58 (d, 10 1H, J = 7.8), 6.64(d, 1H, J = 8.4Hz), 6.85(m, 3H), 7.46(d, 2H, J = 9.0 Hz), 10.59(bris, 1H), 10.71(bris, 1H); MS (ES) m/z: 483.1 (MH⁺); HRMS found for C₂₅H₃₄N₆O₄: 483.2769.

EXAMPLE 385

15 N-(4-{4-[(2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl)-3,4-dimethoxybenzamide

The title compound was prepared according to the procedure of Example 381 as a dark brown solid; ¹H NMR (300 MHz, DMSO-d₆) δ 1.35(m, 2H), 1.89 (m, 2H), 2.70 (m, 3H), 2.85(m, 1H), 3.60(m, 3H), 3.82(s, 3H), 3.83(s, 3H), 4.50(m, 1H), 6.93 (m, 2H), 7.03(m, 2H), 7.19(d, 1H, J = 1.74Hz), 7.57(m, 4H), 7.86(dd, 1H, J = 6.39Hz), 8.03(d, 1H, J = 2.13Hz), 9.11` (s, 1H), 20 9.86(s, 1H); MS (ES)m/z: 585.1 (MH⁺).

EXAMPLE 386

N-{4-[4-((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino]-1-piperidinyl}phenyl}butanamide

25 The title compound was prepared according to the procedure of Example 381 as a grey solid; mp 190-201 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 0.89 (t, 3 H), 1.50-1.80 (m, 4 H), 2.10-2.40 (m, 4 H), 2.50-2.80 (m, 3 H), 3.10-3.30 (m, 2 H), 3.60-3.80 (m, 2 H), 3.90-4.10 (m, 2 H), 4.20-4.35 (m, 1 H), 5.80 (d, 1 H), 6.59 (t, 2 H), 6.80-7.00 (m, 2 H), 7.40-7.60 (m, 3 H), 8.80 (bris, 1 H), 9.20 (bris, 1 H), 9.70 (s, 1 H), 10.65 (s, 1 H), 10.80 (s, 1 H); MS (ES) m/z: 468.0 30 (MH⁺); HRMS Calcd. for C₂₅H₃₄N₄O₄ (MH⁺): 468.2611. Found: 468.2574.

EXAMPLE 387

N-[4-(4-(((2S)-3-(9H-Carbazol-4-yloxy)-2-hydroxypropyl)amino)-1-piperidinyl)phenyl]butanamide

The title compound was prepared according to the procedure of Example 381 as an off-white solid; mp 194-199 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 0.89 (t, 3 H), 1.30-1.45 (m, 2 H), 1.50-1.70 (m, 2 H), 1.80-2.00 (m, 2 H), 2.25 (t, 2 H), 2.50-3.00 (m, 5 H), 3.40-3.60 (m, 2 H), 4.00-4.20 (m, 3 H), 5.10 (brs, 1 H), 6.70(d, 1 H), 6.82 (d, 2 H), 7.00-7.50 (m, 7 H), 8.22 (d, 1 H), 9.60 (s, 1 H), 11.20 (s, 1 H); MS (ES) m/z: 501.0 (MH⁺).

EXAMPLE 388

N-[4-(4-(((2S)-2-Hydroxy-3-(4-hydroxyphenoxy)propyl)amino)-1-piperidinyl)phenyl]-3,4-dimethoxybenzamide

The title compound was prepared according to the procedure of Example 381 as a yellowish solid; mp 77-84 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.40 (m, 2 H), 1.80-1.95 (m, 2 H), 2.50-2.80 (m, 4 H), 3.10-3.40 (m, 1 H), 3.50-3.70 (m, 2 H), 3.82 (s, 3 H), 3.83 (s, 3 H), 3.75-3.90 (m, 3 H), 6.58 (d, 1 H), 6.75 (d, 1 H), 6.91 (d, 2 H), 7.06 (d, 1 H), 7.40-7.70 (m, 4 H), 8.89 (brs, 1 H), 9.86 (s, 1 H); MS (ES) m/z: 522.0 (MH⁺); HRMS Calcd. for C₂₉H₃₆N₃O₆ (MH⁺): 522.2604. Found: 522.2602.

EXAMPLE 389

N-[4-(4-(((2S)-3-(9H-Carbazol-4-yloxy)-2-hydroxypropyl)amino)-1-piperidinyl)phenyl]-3,4-dimethoxybenzamide

The title compound was prepared according to the procedure of Example 381 as a yellowish solid; mp 183-191 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 1.20-1.45 (m, 2 H), 1.80-2.00 (m, 2 H), 2.50-3.40 (m, 5 H), 3.50-3.65 (m, 2 H), 3.73 (s, 3 H), 3.74 (s, 3 H), 4.00-4.20 (m, 3 H), 5.10 (brs, 1 H), 6.70 (d, 1 H), 6.90 (d, 1 H), 6.90-7.60 (m, 11 H), 8.25 (d, 1 H), 9.87 (s, 1 H), 11.30 (s, 1 H); MS (ES) m/z: 595.1 (MH⁺); HRMS Calcd. for C₃₅H₃₈N₄O₅ (MH⁺): 595.2920. Found: 595.2907.

EXAMPLE 390

N-{4-[4-(((2S)-2-Hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)-amino)-1-piperidinyl]phenyl}-1,3-benzodioxole-5-carboxamide

The title compound was prepared according to the procedure of Example 381 as a grey solid; mp 160-169 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 1.30-1.45 (m, 2 H), 1.80-1.95 (m, 2 H),

2.50-2.90 (m, 5 H), 3.50-3.70 (m, 2 H), 3.80-4.10 (m, 3 H), 6.25 (s, 2 H), 6.58 (d, 1 H), 6.64 (d, 1 H), 6.80-7.00 (m, 5 H), 7.05 (d, 2 H), 7.40-7.60 (m, 5 H), 9.85 (s, 1 H), 10.50-10.70 (m, 2 H); MS (ES) m/z: 546.1 (MH⁺); HRMS Calcd. for C₂₉H₃₁N₅O₆ (MH⁺): 546.2353. Found: 546.2343.

5 EXAMPLE 391

N-[4-(4-[(2S)-3-(9H-Carbazol-4-yloxy)-2-hydroxypropyl]amino)-1-piperidinyl]phenyl]-1,3-benzodioxole-5-carboxamide

The title compound was prepared according to the procedure of Example 381 as an off-white solid; mp 217-223 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 1.30-1.45 (m, 2 H), 1.75-2.00 (m, 2 H), 2.50-2.90 (m, 5 H), 3.50-4.30 (m, 5 H), 6.12 (s, 2 H), 6.70 (d, 1 H), 6.80-7.60 (m, 17 H), 9.87 (s, 1 H), 11.30 (s, 1 H); MS (ES) m/z: 579.1 (MH⁺); HRMS Calcd. for C₃₄H₃₅N₄O₅ (MH⁺): 579.2607. Found: 279.2595.

EXAMPLE 392

15 3-Cyclopentyl-N-[4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]phenyl]propanamide

The title compound was prepared according to the procedure of Example 381 as a grey solid; mp 140-144 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 1.00-2.00 (m, 15 H), 2.50 (t, 2 H), 2.50-2.90 (m, 5 H), 3.55 (d, 2 H), 3.80-4.05 (m, 3 H), 4.90 (brs, 1 H), 6.55 (d, 1 H), 6.63 (d, 1 H), 20 6.80-6.90 (m, 3 H), 7.40 (d, 2 H), 9.60 (s, 1 H), 10.60 (brs, 1 H), 10.70 (brs, 1 H); MS (ES) m/z: 522.2 (MH⁺); HRMS Calcd. for C₂₉H₃₉N₅O₄ (MH⁺): 522.3080. Found: 522.3091.

EXAMPLE 393

25 3-Cyclopentyl-N-(4-[4-[(2R)-2-hydroxy-2-[4-hydroxy-3-[(methylsulfonyl)amino]phenyl]-ethyl]amino]-1-piperidinyl]phenyl)propanamide

The title compound was prepared according to the procedure of Example 381 as a red solid; mp 82-90 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 1.00-2.00 (m, 15 H), 2.30 (t, 2 H), 2.50-2.70 (m, 5 H), 3.45 (brd, 2 H), 4.48 (dd, 1 H), 6.70-6.90 (m, 3 H), 6.98 (dd, 1 H), 7.17 (d, 1 H), 7.40 (d, 2 H), 9.61 (s, 1 H); MS (ES) m/z: 545.1 (MH⁺); HRMS Calcd. for C₂₈H₄₁N₄O₅S(MH⁺): 545.2798. Found: 545.2788.

EXAMPLE 394

N-(4-{4-[(2R)-2-Hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl)-1,3-benzodioxole-5-carboxamide

The title compound was prepared according to the procedure of Example 381 as an off-white solid; mp 104-113 °C; ¹H NMR (300 MHz, DMSO-d₆) δ 1.30-1.45 (m, 2 H), 1.80-1.95 (m, 2 H), 2.50-2.80 (m, 5 H), 2.92 (s, 3 H), 3.55 (d, 2 H), 4.49 (dd, 1 H), 6.15 (s, 2 H), 6.80 (d, 1 H), 6.90 (d, 1 H), 6.90-7.10 (m, 3 H), 7.15 (d, 1 H), 7.40-7.60 (m, 4 H), 9.80 (s, 1 H); MS (ES) m/z: 569.0 (MH⁺).

EXAMPLE 395

1-Benzhydryl-3-(tert-butyl-dimethyl-silanyloxy)-azetidine

Tert-butyldimethylsilyl chloride (10.12g, 42.3mmol) was added to a solution of 1-(diphenylmethyl)-3-hydroxyazetidine (7.65g, 50.8mmol) and imidazole (7.2g, 106mmol) in anhydrous dimethylformamide(20mL). The reaction was stirred at room temperature for 24 hours and then treated with water (200mL). The resultant precipitate was captured on a filter and washed with hot water. The solid was dried under reduced pressure to give 14.1g of the desired product as a white solid; ¹H NMR (300 MHz, CDCl₃) δ 0.06 (s, 6H), 0.84(s, 9H), 2.83 (t, 2H, J = 6.42Hz), 3.52(t, 2H, J = 6.09Hz), 4.21(s, 1H), 4.44(m, 1H), 7.18(m, 2H), 7.23(m, 4H), 7.37(d, 4H, J = 8.49Hz); MS (ES) m/z: 354.5 (MH⁺); Anal. Calcd. for C₂₂H₃₁NOSi: C, 74.73; H, 8.84; N, 3.96. Found: C, 74.55; H, 8.75; N, 3.88.

EXAMPLE 396

1-(4-Nitro-phenyl)-azetidin-3-ol

Ammonium formate (15.1g, 246mmol) was added to a solution of 1-benzhydryl-3-(tert-butyl-dimethyl-silanyloxy)-azetidine (which was obtained in Example 395) (8.7g, 24.6mmol) and 10%Pd/C (1g) in methanol(100mL). The reaction was stirred for 3 hours at room temperature. The solution was passed through celite and concentrated to afford a crude solid. The crude solid was taken up in pyridine (75mL) and the salts were removed by filtration. 4-Fluoronitrobenzene (2.9mL, 27.1mmol) was added to the above solution and the reaction was stirred at reflux overnight. Pyridine was removed by vacuum distillation and the resultant crude was treated with water (100mL), followed by extraction with ethyl acetate (3x25mL). The organic layers were combined, dried (Na₂SO₄), filtered, and passed through a plug of silica. The solvent was evaporated and triturated with hexanes to give 3.91g of the desired product as red solid; ¹H NMR (300 MHz, CDCl₃) δ 1.62 (s, 1H), 3.89(m, 2H), 4.31 (m, 2H), 4.87(m, 1H),

6.31(d, 2H, J = 7.14), 8.09(d, 2H, J = 7.14Hz); MS (ES) m/z: 194.8 (MH⁺); Anal. Calcd. for C₉H₁₀N₂O₃: C, 55.67; H, 5.19; N, 14.43. Found: C, 55.67; H, 5.05; N, 14.59.

EXAMPLE 397

5 Methanesulfonic acid 1-(4-nitro-phenyl)-azetidin-3-yl ester

1-(4-Nitro-phenyl)-azetidin-3-ol (which was obtained in Example 396) (5.0g, 25.8 mmol) was added to a solution of methanesulfonyl chloride (2.2mL, 28.3mmol) in dry pyridine (35mL) and stirred at room temperature overnight. Water was added and the resultant precipitate was captured on a filter, washed with water, methanol, and hexanes to give 3.72g of the desired
10 product as an orange solid; ¹H NMR (DMSO-d₆) δ3.35 (s, 3H), 4.15(m, 3H), 4.45(m, 2H), 5.48(m, 1H), 6.53(d, 2H, J = 9.12Hz), 8.09(d, 2H, J = 9.12Hz); MS (ES) m/z: 273.5 (MH⁺); Anal. Calcd. for C₁₀H₁₂N₂O₅S: C, 44.11; H, 4.44; N, 10.29. Found: C, 44.50; H, 4.48; N, 10.64.

EXAMPLE 398

15 Benzyl-[1-(4-nitro-phenyl)-azetidin-3-yl]-amine

Methanesulfonic acid 1-(4-nitro-phenyl)-azetidin-3-yl ester (which was obtained in Example 397) (14.32g, 52.6mmol) was added to neat benzyl amine (56mL, 526mmol) and stirred at 100°C for 2 days. Water (200mL) was added and the resultant precipitate was collected and partitioned between ethyl acetate and saturated aqueous NaHCO₃. The aqueous
20 layer was washed with ethyl acetate (2x50mL). The organic extract was dried over anhydrous sodium sulfate, filtered, and concentrated. The solid was washed with diethyl ether and dried to give 12.1g of the desired product as an orange solid; ¹H NMR (300 MHz, CDCl₃) δ1.66 (brs, 1H), 3.72(m, 2H), 3.82 (s, 2H), 3.89(m, 1H), 4.19(t, 2H, J = 7.77Hz), 6.29(d, 2H, J = 9.12Hz), 7.34(m, 5H), 8.07(d, 2H, J = 9.18Hz); MS (ES) m/z: 283.8 (MH⁺); Anal. Calcd. for C₁₆H₁₇N₃O₂:
25 C, 67.83; H, 6.05; N, 14.83. Found: C, 67.59; H, 6.04; N, 14.79.

EXAMPLE 399

(2S)-1-{Benzyl-[1-(4-nitro-phenyl)-azetidin-3-yl]-amino}-3-(9H-carbazol-4-yloxy)-propan-2-ol

Benzyl-[1-(4-nitro-phenyl)-azetidin-3-yl]-amine (which was obtained in Example 398) (1.95g, 6.87mmol) and (2S)-3-(9H-carbazol-4-yloxy)-methyl oxirane (Berridge et al.,
30 *Int. J. Radial. Appl. Instrum.*, **1992**, 563) (1.64g, 6.87mmol) was stirred at reflux in anhydrous methanol for 24 hours. Methanol was removed in vacuo and the desired product was isolated using silica gel flash chromatography to give 3.01g of product as a yellow solid; ¹H NMR (300 MHz, CDCl₃) δ2.90 (m, 2H), 3.04(s, 1H), 3.85 (m, 3H), 3.98(m, 3H), 4.23(m, 3H), 6.01(d, 2H,
35 J = 7.26Hz), 6.61(d, 1H, J = 8.10Hz), 7.06(d, 1H, J = 8.04Hz), 7.17(t, 1H, J = 2.14Hz), 7.34(m,

7H), 7.97(d, 2H, J = 9.12Hz), 8.14(t, 2H, J = 8.79Hz); MS (ES) m/z: 522.9 (MH⁺); Anal. Calcd. for C₃₁H₃₀N₄O₄: C, 71.25; H, 5.79; N, 10.72. Found: C, 70.77; H, 6.17; N, 9.61.

EXAMPLE 400

(2S)-1-{Benzyl-[1-(4-nitro-phenyl)-azetidin-3-yl]-amino}-3-(4-benzyloxy-phenoxy)-propan-2-ol

Benzyl-[1-(4-nitro-phenyl)-azetidin-3-yl]-amine (which was obtained in Example 398) (2.07g, 7.34mmol) and (2S)-2-(4-benzyloxy-phenoxy-methyl-oxirane (EP 0 714 883) (2.07g, 6.99mmol) were stirred at reflux in anhydrous methanol for 24 hours. Methanol was removed in vacuo and the desired product was isolated using silica gel flash chromatography to give 3.01g of product as a yellow solid; ¹H NMR (300 MHz, CDCl₃) δ2.74 (m, 2H), 2.95(brs, 2H), 3.90 (m, 2H), 3.94(m, 4H), 4.01(m, 2H), 4.05(q, 2H, J = 7.11Hz), 5.01(s, 2H), 6.28(d, 2H, J = 5.28Hz), 6.82(d, 2H, J = 4.35Hz), 6.89(d, 2H, J = 4.35Hz), 7.34(m, 10H), 8.08(d, 2H, J = 5.34Hz); MS (ES) m/z: 540.0 (MH⁺); Anal. Calcd. for C₃₂H₃₃N₃O₅: C, 71.23; H, 6.16; N, 7.79. Found: C, 70.68; H, 6.34; N, 7.61.

EXAMPLE 401

(2S)-1-{[1-(4-Amino-phenyl)-azetidin-3-yl]-benzyl-amino}-3-(4-benzyloxy-phenoxy)-propan-2-ol

Sodium hydrosulfite (3.0g, 17.2mmol) was added to a heterogeneous solution of (2S)-1-{benzyl-[1-(4-nitro-phenyl)-azetidin-3-yl]-amino}-3-(4-benzyloxy-phenoxy)-propan-2-ol(which was obtained in Example 400) (1.0g, 1.72mmol), sodium bicarbonate(1.5g, 1.72mmol) in acetonitrile (15mL), methanol(35mL) and water(10mL). This reaction was stirred at 60°C overnight. Solids were removed by filtration. The mother liquor was concentrated and the resultant crude was taken up in water followed by extraction with ethyl acetate (3x20mL). The organic extract was dried over anhydrous sodium sulfate, passed through a plug of silica, and concentrated to give 0.89g of the desired product as a brown gum; ¹H NMR (300 MHz, CDCl₃) δ2.66(m, 2H), 3.13(brs, 2H), 3.56 (m, 4H), 3.77(m, 2H), 3.90(m, 4H), 4.99(s, 2H), 6.33(d, 2H, J = 4.80Hz), 6.59(d, 2H, J = 6.78Hz), 6.81(d, 2H, J = 9.21Hz), 6.86(d, 2H, J = 6.75), 7.36(m, 10H); MS (ES) m/z: 510.0 (MH⁺).

EXAMPLE 402

N-Acetyl-N-[4-(3-{benzyl-[(2S)-3-(4-benzyloxy-phenoxy)-2-hydroxy-propyl]-amino}-azetidin-1-yl)-phenyl]-acetamide

Acetic anhydride (0.09mL, 0.93mmol) was added to a solution of (2S)-1-{[1-(4-amino-phenyl)-azetidin-3-yl]-benzyl-amino}-3-(4-benzyloxy-phenoxy)-propan-2-ol (which was obtained in Example 401) (0.37g, 0.727mmol) and N,N-dimethylaminopyridine (catalytic amount) in

anhydrous methylene chloride(7mL). The reaction was stirred at room temperature overnight. The solution was then treated with water (30mL) followed by extraction with ethyl acetate (3x30mL). The organic extract was dried with anhydrous sodium sulfate, filtered and concentrated to afford a crude solid. The desired product was isolated using silica gel flash chromatography to give 0.41g of an off-white solid; ¹H NMR (300 MHz, CDCl₃) δ 2.05(s, 3H), 2.12(s, 3H), 2.75(m, 1H), 2.93(m, 1H), 3.49(m, 2H), 3.65(d, 2H, J = 14Hz), 3.75(m, 1H), 3.88(m, 2H), 4.01(d, 2H, J = 4.23Hz), 5.01(s, 2H), 5.18(m, 1H), 6.36(d, 2H, J = 8.4Hz), 6.79(d, 2H, J = 6.78Hz), 6.89(d, 2H, J = 6.78Hz), 7.32(m, 8H), 7.38(m, 4H). MS(ES) m/z: 594.1 (MH⁺).

EXAMPLE 403

N-[4-(3-{Benzyl-[(2S)-3-(4-benzyloxy-phenoxy)-2-hydroxy-propyl]-amino}-azetidin-1-yl)-phenyl]-4-butoxy-benzenesulfonamide

4-Butoxybenzenesulfonyl chloride (0.20g, 0.79mmol) was added to a solution of (2S)-1-[[1-(4-amino-phenyl)-azetidin-3-yl]-benzyl-amino]-3-(4-benzyloxy-phenoxy)-propan-2-ol (which was obtained in Example 401) (0.37g, 0.727mmol) and triethylamine (0.56mL, 3.99mmol) in anhydrous methylene chloride (7mL). The reaction was stirred at room temperature overnight. The solution was then treated with water (30mL) followed by extraction with ethyl acetate (3x30mL). The organic extract was dried with anhydrous sodium sulfate, filtered and concentrated to afford a crude solid. The desired product was isolated using silica gel flash chromatography to give 90mg of an off-white solid; ¹H NMR (300 MHz, CDCl₃) δ 0.99(t, 3H, J = 5.04Hz), 1.47(m, 2H), 1.78(m, 2H), 2.69(m, 2H), 3.08(brs, 1H), 3.65(m, 3H), 3.78(m, 2H), 3.87(m, 4H), 3.95(t, 2H, J = 6.45Hz), 5.01(s, 2H), 6.01(s, 1H), 6.29(d, 2H, J = 8.73Hz), 6.86(m, 10H), 7.35(m, 8H), 7.56(d, 2H, J = 8.94Hz). MS (ES) m/z: 722.1 (MH⁺); Anal. Calcd. for C₄₂H₄₇N₃O₆ S: C, 69.88; H, 6.56; N, 5.82. Found: C, 68.91; H, 6.38; N, 5.55.

EXAMPLE 404

N-[4-(3-{Benzyl-[3-(9H-carbazol-4-yloxy)-2-hydroxy-propyl]-amino}-azetidin-1-yl)-phenyl]-acetamide

The title compound was prepared according to the procedure of Example 403 as an off-white solid; ¹H NMR (DMSO-d₆) δ 1.95(s, 3H), 2.64(m, 1H), 2.82(m, 1H), 3.32(s, 2H), 3.47(m, 2H), 3.67(m, 4H), 4.12(m, 2H), 5.07(d, 1H, J = 4.5Hz), 6.15(d, 2H, J = 8.7Hz), 6.09(d, 1H, J = 8.79Hz), 6.65(d, 1H, J = 7.95Hz), 7.07(m, 2H), 7.26(m, 10H), 7.46(d, 1H, J = 7.71Hz), 8.18(d, 1H, J = 7.71Hz), 9.57(s, 1H), 11.25(s, 1H); MS (ES) m/z: 535.1; (MH⁺); HRMS found for C₃₃H₃₄N₄O₃: 534.2643

EXAMPLE 405

N-[4-(3-{Benzyl-[(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxy-propyl]-amino}-azetidin-1-yl)-phenyl]-4-butoxy-benzenesulfonamide

The title compound was prepared according to the procedure of Example 403 as an off-white solid; ¹H NMR (300 MHz, CDCl₃) δ 0.95(t, 3H, J = 4.95Hz), 1.45(m, 2H), 1.74(m, 2H), 2.83(m, 2H), 3.22(brs, 1H), 3.61(m, 3H), 3.79(s, 1H), 3.84(m, 3H), 3.93(t, 2H, J = 7.29Hz), 4.15(m, 2H), 6.15(d, 2H, J = 8.7Hz), 6.24(s, 1H), 6.59(d, 2H, J = 6.99Hz), 6.84(m, 4H), 7.04(d, 1H, J = 8.01Hz), 7.18(m, 2H), 7.37(m, 2H), 7.54(d, 2H, J = 7.02Hz), 8.17(s, 1H), 8.18(s, 1H); MS (ES) m/z: 705.1 (MH⁺).

EXAMPLE 406

N-[4-(3-{Benzyl-[3-(9H-carbazol-4-yloxy)-2-hydroxy-propyl]-amino}-azetidin-1-yl)-phenyl]-3,4-dimethoxy-benzenesulfonamide

The title compound was prepared according to the procedure of Example 403; ¹H NMR (300 MHz, CDCl₃) δ 2.82(m, 2H), 3.18(brs, 1H), 3.61(m, 3H), 3.75(s, 3H), 3.79(m, 1H), 3.89(s, 3H), 3.93(m, 2H), 4.17(m, 3H), 6.12(s, 1H), 6.21(d, 2H, J = 8.7Hz), 6.63(d, 1H, J = 7.95Hz), 6.83(m, 3H), 7.06(m, 3H), 7.25(m, 1H), 7.28(m, 2H), 7.39(m, 1H), 8.15(s, 1H), 8.21(d, 1H, J = 7.8Hz); MS (ES) m/z: 693.1 (MH⁺); HRMS found for C₃₉H₄₀N₄O₆ S: 693.2731

EXAMPLE 407

N-[4-[4-(3-{Benzyl-[3-(9H-carbazol-4-yloxy)-2-hydroxy-propyl]-amino}-azetidin-1-yl)-phenylsulfamoyl]-phenyl]-acetamide

The title compound was prepared according to the procedure of Example 403; ¹H NMR (300 MHz, CDCl₃) δ 2.17(s, 3H), 2.85(m, 2H), 3.59(m, 3H), 3.68(m, 1H), 3.80(m, 3H), 4.19(m, 3H), 6.13(d, 2H, J = 8.67Hz), 6.06(d, 1H, J = 7.95Hz), 6.86(d, 2H, J = 8.64Hz), 7.08(d, 1H, J = 8.07Hz), 7.14(t, 1H, J = 7.5Hz), 7.31(m, 8H), 7.59(q, 4H, J = 7.71Hz), 8.22(d, 1H, J = 7.71Hz), 8.51(s, 1H), 9.50(s, 1H), 79(s, 1H); MS (ES) m/z: 690.1 (MH⁺); HRMS found for C₃₉H₃₉NO₅S: 690.2777.

EXAMPLE 408

N-[4-(3-{Benzyl-[3-(4-benzyloxy-phenoxy)-2-hydroxy-propyl]-amino}-azetidin-1-yl)-phenyl]-3,4-dimethoxy-benzenesulfonamide

The title compound was prepared according to the procedure of Example 403; ¹H NMR (300 MHz, CDCl₃) δ 2.69(m, 2H), 3.06(brs, 1H), 3.63(m, 3H), 3.78(s, 3H), 3.87(m, 3H), 3.91(s, 3H), 3.93(m, 3H), 5.01(s, 2H), 6.05(s, 1H), 6.29(d, 2H, J = 9.81Hz), 6.82(m, 10H), 7.06(d, 1H),

7.56(d, 2H, J = 6.94Hz), 7.34(m, 10H). MS (ES) m/z: 710.1 (MH⁺); HRMS found for C₄₀H₄₃N₃O₇S: 710.2899.

EXAMPLE 409

5 N-{4-[4-(3-{Benzyl-[3-(4-benzyloxy-phenoxy)-2-hydroxy-propyl]-amino}-azetidin-1-yl)-phenylsulfamoyl]-phenyl}-acetamide

The title compound was prepared according to the procedure of Example 403; ¹H NMR (300 MHz, CDCl₃) δ 2.17(s, 3H), 2.67(m, 2H), 3.15(brs, 1H), 3.62(m, 3H), 3.78(m, 2H), 3.88(m, 4H), 5.01(s, 2H), 6.26(m, 3H), 6.87(m, 6H), 7.34(m, 5H), 7.40(m, 3H), 7.52(d 5H). MS (ES) m/z: 707.1 (MH⁺); HRMS found for C₄₀H₄₂N₄O₈S: 707.2901.

EXAMPLE 410

N-Acetyl-N-[4-(3-{[(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino}-1-azetidiny]phenyl]acetamide

15 Ammonium formate (0.57g, 9.1mmol) was added to a solution of N-acetyl-N-[4-(3-{benzyl-[(2S)-3-(4-benzyloxy-phenoxy)-2-hydroxy-propyl]-amino}-azetidin-1-yl)-phenyl]-acetamide (which was obtained in Example 402) (0.25g, 0.45mmol) and 10% Pd/C (0.05g) in dry methanol (7mL). The reaction was stirred at room temperature overnight. The solution was passed through a pad of celite and then was concentrated. The crude solid was treated with
20 saturated aqueous NaHCO₃ (30mL) followed by extraction with ethyl acetate (3 x 20mL). The organic extract was dried over anhydrous sodium sulfate, filtered, and evaporated to afford 0.18g of the desired product as a white solid; ¹H NMR (300 MHz, CDCl₃) δ 2.05 (s, 6H), 2.61(s, 1H), 2.75(m, 2H), 3.49(m, 2H), 3.75(m, 1H), 3.85(d, 2H, J = 7.13Hz), 4.02(t, 2H, J = 5.3Hz), 4.12(q, 1H), 6.32(d, 2H, J = 11.12Hz), 6.90(d, 2H, J = 11.32Hz), 6.55(q, 4H, J =
25 4.6Hz), 7.53(d, 2H, J = 7.02Hz), 7.61(brs, 1H); MS (ES) m/z: 414.0(MH⁺).

EXAMPLE 411

4-Butoxy-N-[4-(3-{[(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino}-1-azetidiny]phenyl]benzenesulfonamide

30 The title compound was prepared according to the procedure of Example 410 as a dark blue solid; ¹H NMR (300 MHz, DMSO-d₆/CDCl₃) δ 0.97 (t, 3H, J = 7.41Hz), 1.48 (m, 2H), 1.78(m, 2H), 2.58(m, 1H), 2.75(m, 2H), 3.49(m, 2H), 3.75(m, 1H), 3.85(d, 2H), 3.97(t, 2H, J = 5.7Hz), 4.02(t, 2H, J = 7.41Hz), 4.12(q, 1H), 6.26(d, 2H, J = 11.67), 6.75(s, 4H), 6.84, (d, 2H,

J = 5.1Hz), 6.90(d, 2H, J = 11.76Hz), 7.53(d, 2H, J = 6.99Hz), 8.35(bris, 1H), 8.60(bris, 1H); MS (ES) m/z: 542.0(MH⁺); HRMS found for C₂₈H₃₅N₃O₆S: 542.2362.

EXAMPLE 412

5 N-[4-(3-([(2S)-2-Hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-azetidiny]phenyl]-3,4-dimethoxybenzenesulfonamide

The title compound was prepared according to the procedure of Example 410 as a blue solid; ¹H NMR (300 MHz, DMSO-d₆/CDCl₃) δ 2.58(m, 1H), 2.76(m, 2H), 3.41(s, 1H), 3.49(m, 2H), 3.71(m, 1H), 3.80(s, 3H), 3.89(s, 3H), 3.90(d, 2H, J = 3.39 Hz), 4.12(q, 1H), 6.26(d, 2H, J = 5.01Hz), 6.75(s, 4H), 6.83(d, 1H, J = 8.49Hz), 6.90(d, 1H, J = 8.73 Hz), 7.16(d, 1H, J = 2.07 Hz), 7.29(dd, 1H), 8.35(bris, 1H), 8.60(bris, 1H); MS (ES) m/z: 530.0(MH⁺); HRMS found for C₂₆H₃₁N₃O₇S: 530.1991.

EXAMPLE 413

15 N-(4-[4-(3-([(2S)-2-Hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-azetidiny]anilino]-sulfonyl)-phenyl)acetamide

The title compound was prepared according to the procedure of Example 410 as a white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.06, (s 3H), 2.53(m, 1H), 2.61(m, 2H), 3.35(m, 2H), 3.58(m, 1H), 3.78(m, 3H), 3.85(t, 2H), 4.89(bris, 1H), 6.26(d, 2H, J = 8.7Hz), 6.65(d, 2H, J = 6.6Hz), 6.72(d, 2H, J = 2.4Hz), 6.93(d, 2H, J = 1.8Hz), 7.54(d, 2H, J = 9.0Hz), 7.83(d, 2H, J = 8.8Hz) 8.87(s, 1H), 8.45(bris, 1H), 10.26(s, 1H); MS (ES) m/z: 527.1(MH⁺); HRMS found for C₂₆H₃₀N₄O₆S: 527.1975.

EXAMPLE 414

25 4-Butoxy-N-[4-(3-([(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino)-1-azetidiny]phenyl]-benzenesulfonamide

The title compound was prepared according to the procedure of Example 410 as an off-white solid; ¹H NMR (300 MHz, CDCl₃) δ 0.97 (t, 3H, J = 7.47Hz), 1.48 (m, 2H), 1.78(m, 2H), 3.01(m, 2H), 3.47(m, 2H), 3.95(t, 2H, J = 5.94Hz), 4.04(d, 2H, J = 6.66), 4.29(m, 2H), 4.32(m, 1H), 6.15(bris, 1H), 6.26(d, 2H, J = 8.73Hz), 6.67(d, 1H, J = 7.95Hz), 6.83, (d, 2H, J = 2.7Hz), 7.07(d, 1H, J = 8.01Hz), 7.22(m, 2H), 7.32(t, 2H, J = 8.04Hz), 7.41(m, 2H), 7.57(d, 2H, J = 5.04Hz), 8.13(bris, 1H), 8.25(d, 1H, J = 7.77Hz); MS (ES) m/z: 615.1(MH⁺); HRMS found for C₃₄H₃₈N₄O₅S: 615.2656.

EXAMPLE 415

N-[4-(3-[(2S)-3-(9H-Carbazol-4-yloxy)-2-hydroxypropyl]amino)-1-azetidiny]phenyl]acetamide

The title compound was prepared according to the procedure of Example 410 as a dark brown solid; ¹H NMR (300 MHz, CDCl₃) δ 2.05(s, 3H), 3.01(m, 2H), 3.47(m, 2H), 3.95(m, 2H), 4.04(m, 2H), 4.29(m, 2H), 6.35(d, 1H, J = 6.3Hz), 6.69(d, 1H, J = 6.9Hz), 7.04, (brs, 1H), 7.21(m, 1H), 7.29(m, 2H), 7.32(m, 2H), 7.41(m, 2H), 7.30(m, 2H), 8.10(brs, 1H), 8.27(m, 1H); MS (ES) m/z: 445.1(MH⁺).

EXAMPLE 416

N-[4-(3-[(2S)-3-(9H-Carbazol-4-yloxy)-2-hydroxypropyl]amino)-1-azetidiny]phenyl]-3,4-dimethoxybenzenesulfonamide

The title compound was prepared according to the procedure of Example 410 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.76(m, 2H), 3.18(d, 2H, J = 5.22Hz), 3.72(s, 3H), 3.78(s, 3H), 3.93(t, 2H, J = 6.96Hz), 4.02(m, 1H), 4.14(m, 2H), 4.19(m, 1H), 5.11(d, 1H, J = 4.92Hz), 6.2(d, 2H, J = 9.0Hz), 6.69(d, 2H, J = 8.1Hz), 6.85(d, 2H, J = 8.7Hz), 7.13(m, 2H), 7.17(m, 2H), 7.33(m, 2H), 7.43(d, 2H, J = 8.1Hz), 8.21(d, 1H, J = 7.8Hz), 9.45(brs, 1H); MS (ES) m/z: 603.0(MH⁺); HRMS found for C₃₂H₃₄N₄O₆S: 603.2296.

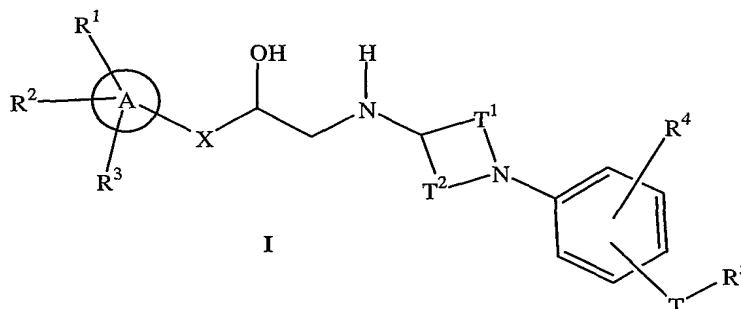
EXAMPLE 417

N-(4-[4-(3-[(2S)-3-(9H-Carbazol-4-yloxy)-2-hydroxypropyl]amino)-1-azetidiny]anilino)sulfonyl]phenyl]acetamide

The title compound was prepared according to the procedure of Example 410 as an off-white solid; ¹H NMR (300 MHz, DMSO-d₆) δ 2.06(s, 3H), 2.71(m, 2H), 3.40(m, 2H), 3.68(m, 1H), 3.93 (t, 2H, J = 6.93Hz), 4.02(m, 2H), 4.13(m, 1H), 5.09(d, 1H, J = 4.95Hz), 6.25(d, 2H, J = 8.7Hz), 6.47(d, 1H, J = 8.7Hz), 6.81(d, 2H, J = 8.7Hz), 7.13(m, 2H), 7.27(m, 2H), 7.46(d, 2H, J = 8.1Hz), 7.68(d, 2H, J = 9.0Hz), 8.21(d, 1H, J = 7.8Hz), 9.50(brs, 1H), 10.27(brs, 1H), 11.24(s, 1H); MS (ES) m/z: 600.0(MH⁺); HRMS found for C₃₂H₃₃N₅O₅S: 600.2280.

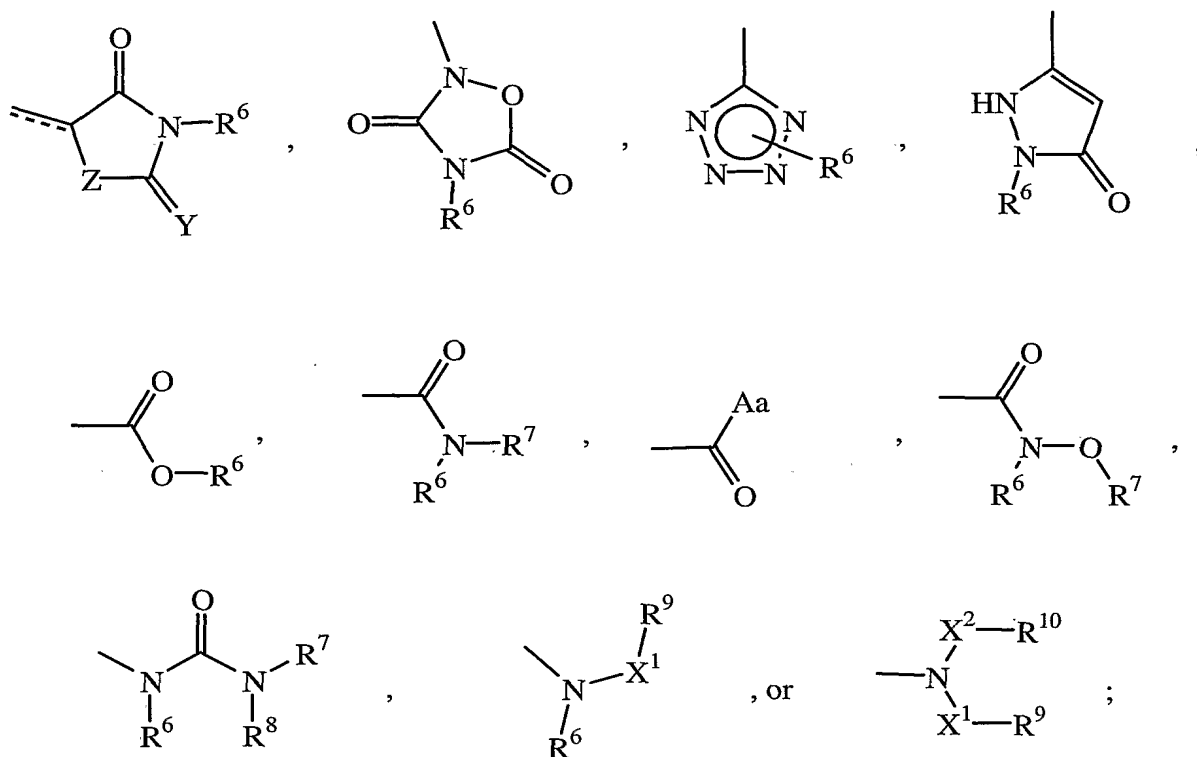
CLAIMS.

1. A compound of formula I having the structure



- 5 wherein;
 A is Ar or Het;
 X is -OCH₂-, -SCH₂-, or a bond;
 T¹ is (CH₂)_m;
 T² is (CH₂)_n;
- 10 T is a bond, alkyl of 1-6 carbon atoms optionally substituted with R¹¹, alkenyl of 2-7 carbon atoms optionally substituted with R¹¹, alkynyl of 2-7 carbon atoms, alkylthio of 1-6 carbon atoms, alkylamino of 1-6 carbon atoms, alkoxyalkyl of 1-6 carbon atoms per alkyl moiety, alkylthioalkyl of 1-6 carbon atoms per alkyl moiety, alkoxy of 1-6 carbon atoms, alkoxyalkyl of 1-6 carbon atoms per alkyl moiety, alkyloxyalkyl of 1-6 carbon atoms per alkyl moiety, acyl of 2-7 carbon atoms, or alkenylcarbonyl of 3-8 carbon atoms;
- 15 R¹, R², and R³ are each, independently, hydrogen, alkyl of 1-6 carbon atoms, cycloalkyl of 3-8 carbon atoms, hydroxy, halogen, trifluoromethyl, alkoxy of 1-6 carbon atoms, benzyloxy, allyloxy, propargyloxy, acyloxy of 2-7 carbon atoms, cyano, nitro, amino, aminocarbonyl, alkylamino of 1-6 carbon atoms, dialkylamino of 1-6 carbon atoms per alkyl group, formamido, ureido, acylamino of 2-7 carbon atoms, alkylsulfonylamino of 1-6 carbon atoms, arylsulfonylamino, dialkyloxyphosphorylamino of 1-6 carbon atoms per alkyl group, dihydroxyphosphorylamino, -CO₂-alkyl of 1-6 carbon atoms, or Ar optionally substituted with R¹¹;
- 20 R⁴ is hydrogen, alkyl of 1-6 carbon atoms, halogen, hydroxy, alkoxy of 1-6 carbon atoms, alkylthio of 1-6 carbon atoms, amino, alkylamino of 1-6 carbon atoms, carboxy, acyl of 2-7 carbon atoms, ArCO-, alkoxy carbonyl of 2-7 carbon atoms, aminocarbonyl, alkylaminocarbonyl of 2-7 carbon atoms, alkylsulfonyl of 1-6 carbon atoms, or alkylsulfonylamino of 1-6 carbon atoms,

R⁵ is



- 5 Aa is (i) an amino acid, wherein the nitrogen of amino acid attached to the adjacent carbonyl of R⁵; or (ii) an alkyl ester of an amino acid, wherein the nitrogen of amino acid attached to the adjacent carbonyl of R⁵, and the alkyl moiety of the alkyl ester contains 1-6 carbon atoms;

Y and Z are each, independently, NR⁷, O, or S;

- 10 X¹ and X² are each, independently, CO or SO₂;

a dotted line represents and optional double bond;

- 15 R⁶, R⁷, and R⁸ are each, independently, hydrogen; alkyl of 1-6 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; alkenyl of 2-7 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; alkynyl of 2-7 carbon atoms optionally substituted with R¹¹; cycloalkyl of 3-8 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; bicycloalkyl of 7-11 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; -CO₂-alkyl of 1-6 carbon atoms; Het optionally substituted by R¹¹, R¹², or R¹³; or Ar optionally substituted by R¹¹, R¹², and R¹³; or when R⁶ and R⁷ are contained on a common

nitrogen, they may be taken together to form a saturated 5-7 membered heterocycle that is optionally substituted with R¹¹;

R⁹ and R¹⁰ are each, independently, alkyl optionally substituted by R¹¹, R¹², and R¹³; Ar optionally mono-, di-, or tri-substituted by R¹⁵; Ar fused to a cycloalkyl ring of 3-8 carbon atoms, and optionally mono-, di-, or tri-substituted by R¹⁵; Het optionally mono-, di-, or tri-substituted by R¹⁵;

R¹¹, R¹², or R¹³ are each, independently, alkyl of 1-6 carbon atoms, halogen, alkenyl of 2-7 carbon atoms, alkynyl of 2-7 carbon atoms, cycloalkyl of 3-8 carbon atoms, Ar-alkyl having 1-6 carbon atoms in the alkyl moiety, Ar optionally substituted with R¹⁴, Het optionally substituted with R¹⁴, hydroxy, alkoxy of 1-6 carbon atoms, Ar-oxy, oxo, -CN, -CHO, -CO₂H, -OCO₂-alkyl of 1-6 carbon atoms, -CO₂-alkyl of 1-6 carbon atoms, -CO₂-Ar, -CO₂-alkyl-Ar wherein the alkyl moiety has 1-6 carbon atoms, -OCO₂-Ar, -CONH₂, -CONHOH, amino, alkylamino of 1-6 carbon atoms, dialkylamino of 1-6 carbon atoms per alkyl moiety, -NHCONH-alkyl of 1-6 carbon atoms, -NHSO₂-alkyl of 1-6 carbon atoms, -NHSO₂-Ar, or -NHSO₂-Het; or when R¹¹ and R¹² are contained on a common carbon atom of an alkyl moiety, they may be taken together to form a spiro cycloalkyl ring of 3-8 carbon atoms;

R¹⁴ is halogen, alkoxy of 1-6 carbon atoms, alkyl of 1-6 carbon atoms, alkenyl of 2-7 carbon atoms, alkynyl of 2-7 carbon atoms, hydroxy, acyl of 2-7 carbon atoms, -SO₂-alkyl of 1-6 carbon atoms, -CO₂-alkyl of 1-6 carbon atoms, or alkoxycarbonylalkyl of 3-13 carbon atoms;

R¹⁵ is

(a) hydroxy, halogen, -CN, -NR¹⁶R¹⁶, -OR¹⁶, -SR¹⁶, trifluoromethyl, alkyl of 1-6 carbon atoms, -SO₂R¹⁷, -O-alkyl-CO₂R¹⁷ wherein the alkyl moiety contains 1-6 carbon atoms, -CO₂R¹⁷, -OCOR¹⁷, -NR¹⁶COR¹⁷, -COR¹⁷, -NR¹⁶SO₂R¹⁷, or -NR¹⁶CO₂R¹⁶; or

(b) alkyl of 1-6 carbon atoms mono-, or di-substituted with hydroxy; halogen; -CN; -NR¹⁶NR¹⁶; -OR¹⁶; -SR¹⁶; trifluoromethyl; alkyl of 1-6 carbon atoms; -SO₂R¹⁷; -CO₂R¹⁷; -OCOR¹⁷; -NR¹⁶COR¹⁷; -COR¹⁷; -NR¹⁶SO₂R¹⁷; -NR¹⁶CO₂R¹⁶; Ar which may be optionally mono- or di-substituted by R¹⁶,

-OR¹⁶, -NR¹⁶R¹⁶, or halogen; or Het which may be optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen;

(c) Het optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen; or

(d) Ar optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen;

5 R¹⁶ is hydrogen, alkyl of 1-6 carbon atoms, cycloalkylalkyl of 4-14 carbon atoms, benzyl, Ar or Het, wherein the Ar or Het moieties may be optionally mono-, di-, or tri- substituted with halogen, nitro, alkylamino of 1-6 carbon atoms, dialkylamino of 1-6 carbon atoms per alkyl moiety, trifluoromethyl, alkyl of 1-6 carbon atoms, alkoxy of 1-6 carbon atoms, alkylthio of 1-6 carbon atoms, -CO₂H, -CO₂alkyl of 1-6 carbon atoms, or -SO₂alkyl of
10 1-6 carbon atoms;

R¹⁷ is R¹⁶ or -NR¹⁶R¹⁶;

Het is a monocyclic or bicyclic heterocycle of 5-10 ring atoms, having 1-4 heteroatoms selected from oxygen, nitrogen, and sulfur; wherein the heterocycle may be saturated, unsaturated, or partially unsaturated; and may be optionally fused to a phenyl ring;
15 wherein one or more of the ring carbon atoms of Het may be a carbonyl moiety, where the ring does not contain a double bond in the position corresponding to that carbon atom;

Ar is an aromatic ring system containing 1-2 carbocyclic aromatic rings having 6-10 carbon atoms;

20 m = 1-3;

n = 1-3;

or a pharmaceutically acceptable salt thereof.

2. A compound according to either Claim 1 wherein X is -OCH₂-.

25

3. A compound according to either Claim 1 wherein X is a bond.

4. A compound according to any of Claims 1-3 wherein;

T is a bond, alkyl of 1-6 carbon atoms optionally substituted with R¹¹, alkenyl of 2-7 carbon atoms optionally substituted with R¹¹, or alkoxyalkyl of 1-6 carbon atoms per alkyl moiety.
30

5. A compound according to any of Claims 1-4 wherein;

R¹, R², and R³ are each, independently, hydrogen, alkyl of 1-6 carbon atoms, hydroxy, halogen, trifluoromethyl, alkoxy of 1-6 carbon atoms, benzyloxy, acyloxy of 2-7 carbon atoms,

cyano, nitro, amino, aminocarbonyl, alkylamino of 1-6 carbon atoms, dialkylamino of 1-6 carbon atoms per alkyl group, acylamino of 2-7 carbon atoms, alkylsulfonylamino of 1-6 carbon atoms, arylsulfonylamino, -CO₂-alkyl of 1-6 carbon atoms, or Ar optionally substituted with R¹¹.

5

6. A compound according to any of Claims 1-5 wherein R⁴ is hydrogen.

7. A compound according to any of Claims 1-5 wherein R⁴ is halogen.

10 8. A compound according to any of Claims 1-7 wherein X¹ is CO.

9. A compound according to any of Claims 1-7 wherein X¹ is SO₂.

10. A compound according to any of Claims 1-9 wherein;

15 R⁶, R⁷, and R⁸ are each, independently, hydrogen; alkyl of 1-6 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; cycloalkyl of 3-8 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; bicycloalkyl of 7-11 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; -CO₂-alkyl of 1-6 carbon atoms; Het optionally substituted by R¹¹, R¹², or R¹³; or Ar optionally substituted by R¹¹, R¹², and R¹³; or when R⁶ and R⁷ are contained on a common
20 nitrogen, they may be taken together to form a saturated 5-7 membered heterocycle that is optionally substituted with R¹¹.

11. A compound according to any of Claims 1-10 wherein;

R¹⁴ is halogen, alkoxy of 1-6 carbon atoms, alkyl of 1-6 carbon atoms, hydroxy, acyl of 2-7
25 carbon atoms, -SO₂-alkyl of 1-6 carbon atoms, -CO₂-alkyl of 1-6 carbon atoms, or alkoxycarbonylalkyl of 3-13 carbon atoms.

12. A compound according to any of Claims 1-11 wherein;

R¹⁵ is

30 (a) halogen, -CN, -OR¹⁶, trifluoromethyl, alkyl of 1-6 carbon atoms, -SO₂R¹⁷, -O-alkyl-CO₂R¹⁷ wherein the alkyl moiety contains 1-6 carbon atoms, -CO₂R¹⁷, -NR¹⁶COR¹⁷, -COR¹⁷; or

(b) alkyl of 1-6 carbon atoms mono-, or di-substituted with halogen; $-NR^{16}COR^{17}$; Ar which may be optionally mono- or di-substituted by R^{16} , $-OR^{16}$, $-NR^{16}R^{16}$, or halogen; or Het which may be optionally mono- or di-substituted by R^{16} , $-OR^{16}$, $-NR^{16}R^{16}$, or halogen;

- 5 (c) Het optionally mono- or di-substituted by R^{16} , $-OR^{16}$, $-NR^{16}R^{16}$, or halogen; or
 (d) Ar optionally mono- or di-substituted by R^{16} , $-OR^{16}$, $-NR^{16}R^{16}$, or halogen.

13. A compound according to any of Claims 1-12 wherein Ar is phenyl.

10 14. A compound according to any of Claims 1-13 wherein m is 1 or 2.

15. A compound according to any of Claims 1-14 wherein n is 1 or 2.

16. A compound according to Claim 1 wherein

15 A is Ar or Het;

X is $-OCH_2-$ or a bond;

T^1 is $(CH_2)_m$;

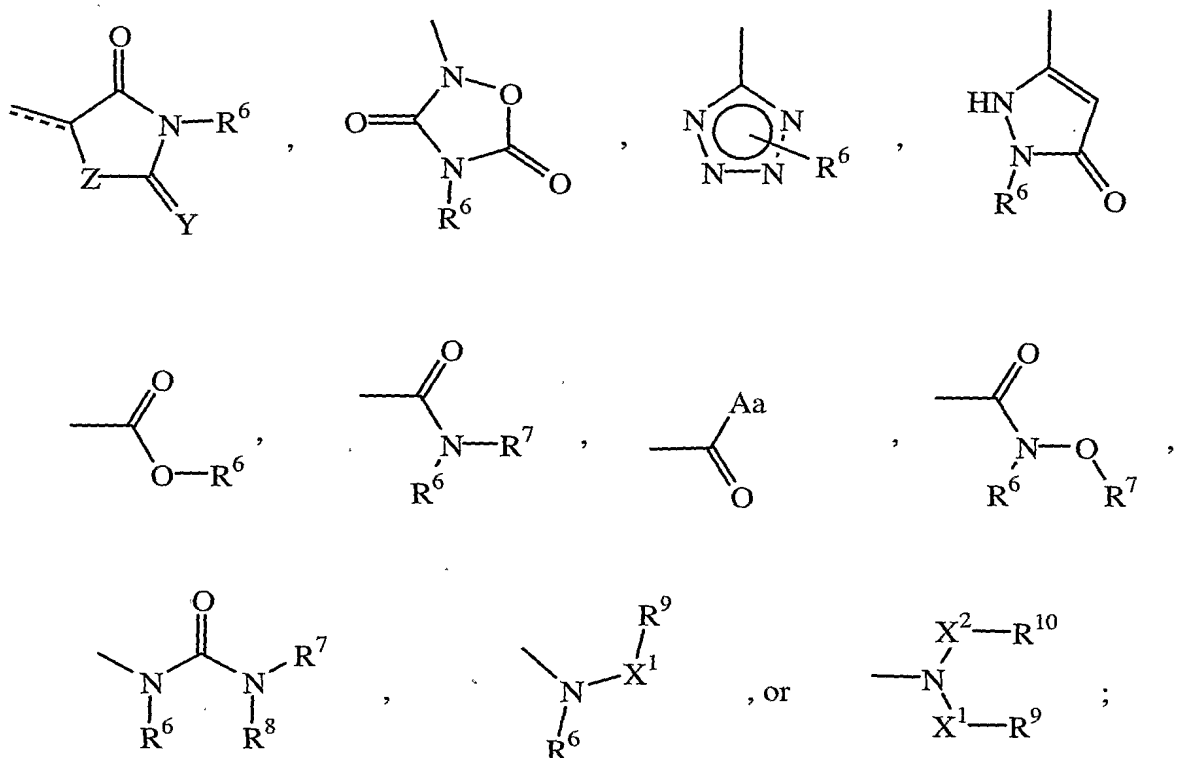
T^2 is $(CH_2)_n$;

20 T is a bond, alkyl of 1-6 carbon atoms optionally substituted with R^{11} , alkenyl of 2-7 carbon atoms optionally substituted with R^{11} , or alkoxyalkyl of 1-6 carbon atoms per alkyl moiety;

25 R^1 , R^2 , and R^3 are each, independently, hydrogen, alkyl of 1-6 carbon atoms, hydroxy, halogen, trifluoromethyl, alkoxy of 1-6 carbon atoms, benzyloxy, acyloxy of 2-7 carbon atoms, cyano, nitro, amino, aminocarbonyl, alkylamino of 1-6 carbon atoms, dialkylamino of 1-6 carbon atoms per alkyl group, acylamino of 2-7 carbon atoms, alkylsulfonylamino of 1-6 carbon atoms, arylsulfonylamino, $-CO_2$ -alkyl of 1-6 carbon atoms, or Ar optionally substituted with R^{11} ;

R^4 is hydrogen or halogen;

R⁵ is



Aa is (i) an amino acid, wherein the nitrogen of amino acid attached to the adjacent carbonyl of R⁵; or (ii) an alkyl ester of an amino acid, wherein the nitrogen of amino acid attached to the adjacent carbonyl of R⁵, and the alkyl moiety of the alkyl ester contains 1-6 carbon atoms;

Y and Z are each, independently, NR⁷, O, or S;

X¹ and X² are each, independently, CO or SO₂;

a dotted line represents an optional double bond;

R⁶, R⁷, and R⁸ are each, independently, hydrogen; alkyl of 1-6 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; cycloalkyl of 3-8 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; bicycloalkyl of 7-11 carbon atoms optionally substituted by R¹¹, R¹², and R¹³; -CO₂-alkyl of 1-6 carbon atoms; Het optionally substituted by R¹¹, R¹², or R¹³; or Ar optionally substituted by R¹¹, R¹², and R¹³; or when R⁶ and R⁷ are contained on a common nitrogen, they may be taken together to form a saturated 5-7 membered heterocycle that is optionally substituted with R¹¹;

R⁹ and R¹⁰ are each, independently, alkyl optionally substituted by R¹¹, R¹², and R¹³; Ar optionally mono-, di-, or tri-substituted by R¹⁵; Het optionally mono-, di-, or tri-substituted by R¹⁵;

R¹¹, R¹², or R¹³ are each, independently, alkyl of 1-6 carbon atoms, halogen, alkenyl of 2-7 carbon atoms, alkynyl of 2-7 carbon atoms, cycloalkyl of 3-8 carbon atoms, Ar-alkyl having 1-6 carbon atoms in the alkyl moiety, Ar optionally substituted with R¹⁴, Het optionally substituted with R¹⁴, hydroxy, alkoxy of 1-6 carbon atoms, Ar-oxy, oxo, -CN, -CHO, -CO₂H, -OCO₂-alkyl of 1-6 carbon atoms, -CO₂-alkyl of 1-6 carbon atoms, -CO₂-Ar, -CO₂-alkyl-Ar wherein the alkyl moiety has 1-6 carbon atoms, -OCO₂-Ar, -CONH₂, -CONHOH, amino, alkylamino of 1-6 carbon atoms, dialkylamino of 1-6 carbon atoms per alkyl moiety, -NHCONH-alkyl of 1-6 carbon atoms, -NHSO₂-alkyl of 1-6 carbon atoms, -NHSO₂-Ar, or -NHSO₂-Het; or when R¹¹ and R¹² are contained on a common carbon atom of an alkyl moiety, they may be taken together to form a spiro cycloalkyl ring of 3-8 carbon atoms;

R¹⁴ is halogen, alkoxy of 1-6 carbon atoms, alkyl of 1-6 carbon atoms, hydroxy, acyl of 2-7 carbon atoms, -SO₂-alkyl of 1-6 carbon atoms, -CO₂-alkyl of 1-6 carbon atoms, or alkoxycarbonylalkyl of 3-13 carbon atoms;

R¹⁵ is

(a) halogen, -CN, -OR¹⁶, trifluoromethyl, alkyl of 1-6 carbon atoms, -SO₂R¹⁷, -O-alkyl-CO₂R¹⁷ wherein the alkyl moiety contains 1-6 carbon atoms, -CO₂R¹⁷, -NR¹⁶COR¹⁷, -COR¹⁷; or

(b) alkyl of 1-6 carbon atoms mono-, or di-substituted with halogen; -NR¹⁶COR¹⁷; Ar which may be optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen; or Het which may be optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen;

(c) Het optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen; or

(d) Ar optionally mono- or di-substituted by R¹⁶, -OR¹⁶, -NR¹⁶R¹⁶, or halogen;

R¹⁶ is hydrogen, alkyl of 1-6 carbon atoms, cycloalkylalkyl of 4-14 carbon atoms, benzyl, Ar or Het, wherein the Ar or Het moieties may be optionally mono-, di-, or tri-substituted with halogen, nitro, alkylamino of 1-6 carbon atoms, dialkylamino of 1-6 carbon atoms per alkyl moiety, trifluoromethyl, alkyl of 1-6 carbon atoms, alkoxy of 1-6 carbon atoms,

alkylthio of 1-6 carbon atoms, -CO₂H, -CO₂alkyl of 1-6 carbon atoms, or -SO₂alkyl of 1-6 carbon atoms;

R¹⁷ is R¹⁶ or -NR¹⁶R¹⁶;

Het is a monocyclic or bicyclic heterocycle of 5-10 ring atoms, having 1-4 heteroatoms selected from oxygen, nitrogen, and sulfur; wherein the heterocycle may be saturated, unsaturated, or partially unsaturated; and may be optionally fused to a phenyl ring; wherein one or more of the ring carbon atoms of Het may be a carbonyl moiety, where the ring does not contain a double bond in the position corresponding to that carbon atom;

Ar is an aromatic ring system containing 1-2 carbocyclic aromatic rings having 6-10 carbon atoms;

m = 1-2;

n = 1-2;

or a pharmaceutically acceptable salt thereof.

15

17. A compound of Claim 1 which is

- a) N-[5-((1R)-2-{1-[4-(3,5-dioxo-[1,2,4]oxadiazolidin-2-yl)methyl]-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide;
- b) 5-[[4-[4-[(R)-2-hydroxy-2-[4-hydroxy-3-[(methylsulfonyl)amino]phenyl]ethyl]amino]-1-piperidinyl]phenyl]methyl]-2,4-dioxo-3-thiazolidineacetic acid tert-butyl-ester;
- c) 5-[[4-[4-[(R)-2-hydroxy-2-[4-hydroxy-3-[(methylsulfonyl)amino]phenyl]ethyl]amino]-1-piperidinyl]phenyl]methyl]-2,4-dioxo-3-thiazolidineacetic acid;
- d) 5-[[4-[4-[(R)-2-hydroxy-2-[4-hydroxy-3-[(methylsulfonyl)amino]phenyl]ethyl]amino]-1-piperidinyl]phenyl]methyl]-2,4-dioxo-3-thiazolidineacetic acid ethyl-ester;
- e) 5-(3-fluoro-4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)-propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;
- f) 5-(3-bromo-4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)-propylamino]-piperidin-1-yl}-benzylidene)-thiazolidine-2,4-dione;
- g) 5-(3-fluoro-4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)-propylamino]-piperidin-1-yl}-benzylidene)-thiazolidine-2,4-dione;
- h) N-[5-(2-{1-[2-bromo-4-(2,4-dioxo-thiazolidin-5-ylidenemethyl)]phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide;
- i) N-[5-(2-{1-[4-(2,4-dioxo-thiazolidin-5-ylidenemethyl)-2-fluoro-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-methanesulfonamide;
- j) 5-{4-[4-((2S)-2-hydroxy-3-phenoxy-propylamino)-piperidin-1-yl]-benzylidene}-2-thioxo-thiazolidin-4-one;

- k) 5-{4-[4-((2S)-2-hydroxy-3-phenoxy-propylamino)-piperidin-1-yl]-benzyl}-thiazolidin-2,4-dione;
- l) 5-(4-{4-[(2S)-3-(4-benzyloxy-phenoxy)-2-hydroxy-propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;
- 5 m) 5-(4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)-propylamino]-piperidin-1-yl}-benzylidene)-thiazolidine-2,4-dione;
- n) 5-(4-{4-[(2S)-2-hydroxy-3-(4-hydroxy-phenoxy)-propylamino]-piperidin-1-yl}-benzylidene)-thiazolidine-2,4-dione;
- o) N-[5-(2-{1-[4-(2,4-dioxo-thiazolidin-5-ylidenemethyl)phenyl]piperidin-4-ylamino}-1-hydroxyethyl)-2-hydroxy-phenyl]-methanesulfonamide;
- 10 p) N-[5-(2-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxyethyl)-2-hydroxy-phenyl]-methanesulfonamide;
- q) 5-(4-{4-[2-(3-chloro-phenyl)-(2R)-2-hydroxyethylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;
- 15 r) 5-(4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)-propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;
- s) 5-(4-{4-[(2S)-2-hydroxy-3-(4-hydroxy-phenoxy)-propylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;
- t) 5-(4-{4-[(2S)-2-hydroxy-3-(4-hydroxy-phenoxy)-propylamino]-piperidin-1-yl}-benzylidene)-2-thioxo-thiazolidin-4-one;
- 20 u) 5-{4-[4-((2S)-2-hydroxy-3-phenoxy-propylamino)-piperidin-1-yl]-benzylidene}-thiazolidine-2,4-dione;
- v) N-[5-((2R)-2-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxyethyl)-2-hydroxy-phenyl]-methanesulfonamide;
- 25 w) N-[5-(2-{1-[4-(2,5-dioxo-imidazolidin-4-ylidenemethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxyethyl)-2-hydroxy-phenyl]-methanesulfonamide;
- x) 5-(4-{4-[2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)propylamino]piperidin-1-yl}-benzyl)-imidazolidine-2,4-dione-piperidin-1-yl}-benzyl)-imidazolidine-2,4-dione;
- y) N-[5-(2-{1-[4-(2,5-dioxo-imidazolidin-4-ylmethyl)phenyl]piperidin-4-ylamino}-1-hydroxyethyl)-2-hydroxy-phenyl]-methanesulfonamide;
- 30 z) N-[2-hydroxy-5-(1-hydroxy-2-{1-[4-(2-imino-4-oxo-thiazolidin-5-ylidenemethyl)-phenyl]-piperidin-4-ylamino}-ethyl)-phenyl]-methanesulfonamide;
- aa) 4-((2S)-2-hydroxy-3-{1-[4-(2-imino-4-oxo-thiazolidin-5-ylmethyl)phenyl]piperidin-4-ylamino}-propoxy)-1,3-dihydro-benzoimidazol-2-one;
- 35 bb) N-[2-hydroxy-5-(1-hydroxy-2-{1-[4-(2-imino-4-oxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-ethyl)-phenyl]-methanesulfonamide;

- cc) 5-(4-{4-[(2S)-2-hydroxy-3-(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-quinolin-5-yloxy)-propyl-amino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;
- dd) N-[5-((2S)-3-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-2-hydroxy-propoxy)-2-hydroxy-phenyl]-methanesulfonamide;
- 5 ee) N-[5-((2S)-3-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)phenyl]piperidin-4-ylamino}-2-hydroxy-propoxy)-2-hydroxy-phenyl]-benzenesulfonamide;
- ff) (R)-propane-2-sulfonic acid [5-(2-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-2-hydroxy-phenyl]-amide;
- gg) N-[2-chloro-5-((1R)-2-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]-piperidin-4-ylamino}-1-hydroxy-ethyl)-phenyl]-methanesulfonamide;
- 10 hh) N-(5-((1R)-2-[(1-[4-[(2,4-dioxo-1,3-thiazolidin-5-yl)methyl]phenyl]piperidin-4-yl)amino]-1-hydroxyethyl)-2-hydroxyphenyl)benzenesulfonamide;
- ii) N-[2-hydroxy-5-(1-hydroxy-2-{1-[4-(1H-tetrazol-5-yl)-phenyl]-piperidin-4-ylamino}-ethyl)-phenyl]-methanesulfonamide;
- 15 jj) ethyl [5-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}phenyl)-1H-tetrazol-1-yl] acetate;
- kk) [5-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl)-1H-tetrazol-1-yl] acetic acid;
- ll) [5-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl)-2H-tetrazol-2-yl]acetic acid;
- 20 mm) 5-{4-[4-((2S)-2-hydroxy-2-[2-(trifluoromethyl)-1,3-thiazol-4-yl]ethyl)amino]piperidine-1-yl}benzyl]-1,3-thiazolidine-2,4-dione;
- nn) 5-{4-[4-((2S)-2-[3-(3,4-dichlorophenyl)isoxazol-5-yl]-2-hydroxyethyl)amino]piperidine-1-yl}benzyl]-1,3-thiazole-2,4-dione;
- 25 oo) N-(4-((1R)-2-[(1-[4-[(2,4-dioxo-1,3-thiazolidin-5-yl)methyl]phenyl]piperidine-4yl)amino]-1-hydroxyethyl))phenylmethanesulfonamide;
- pp) 5-[4-(4-{[4-(2S)-2-(3-bromoisoxazol-5-yl)-2-hydroxyethyl]amino}piperidine-1-yl)benzyl]-1,3-thiazolidine-2,4-dione;
- qq) 5-(4-{4-[(2S)-2-hydroxy-3-(pyridin-3-yloxy)-propylamino]-piperidin-1-yl}benzyl)-thiazolidine-2,4-dione;
- 30 rr) 5-(4-{4-[(2S)-2-hydroxy-3-(6-methyl-pyridin-3-yloxy)-propylamino]piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione;
- ss) 5-{4-[4-((2S)-2-hydroxy-2-pyridin-3-yl-ethylamino)-piperidin-1-yl]benzyl}-thiazolidine-2,4-dione;
- 35 tt) 5-(4-{4-[(2S)-2-(6-amino-pyridin-3-yl)-2-hydroxy-ethylamino]-piperidin-1-yl}-benzyl)-thiazolidine-2,4-dione hydrochloride;

- uu) 5-{4-[4-((2R)-2-hydroxy-2-pyridin-3-yl-ethylamino)piperidin-1-yl]benzyl}thiazolidine-2,4-dione;
- vv) N-[5-(2-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-phenyl]piperidin-4-ylamino}-1-hydroxy-ethyl)-pyridin-2-yl]-methanesulfonamide;
- 5 ww) 5-(3-{1-[4-(2,4-dioxo-thiazolidin-5-ylmethyl)-2-fluoro-phenyl]-piperidin-4-ylamino}-(2S)-2-hydroxy-propoxy)-2-methyl-1H-indole-3-carboxylic acid ethyl ester;
- xx) N-[(2R)-2-hydroxy-5-(1-hydroxy-2-{1-[4-(5-oxo-2,5-dihydro-1H-pyrazol-3-yl)-phenyl]-piperidin-4-ylamino}-ethyl)-phenyl]-methanesulfonamide;
- yy) 4-{4-[(2S)-2-hydroxy-3-(2-oxo-2,3-dihydro-1H-benzoimidazol-4-yloxy)-propylamino]-piperidin-1-yl}-benzoic acid ethyl ester;
- 10 zz) {4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoic acid ethyl ester;
- aaa) {4-[(2R)-2-(3-chloro-phenyl)-2-hydroxy-ethylamino]-piperidin-1-yl}-benzoic acid ethyl ester hydrochloride;
- 15 bbb) (4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethylamino]-piperidin-1-yl}-phenyl)-acetic acid;
- ccc) 3-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethylamino]-piperidin-1-yl}-phenyl)-acrylic acid ethyl ester;
- ddd) 3-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethylamino]-piperidin-1-yl}-phenyl)-propionic acid;
- 20 eee) (4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethylamino]-piperidin-1-yl}-benzyloxy)-acetic acid;
- fff) 4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethylamino]-piperidin-1-yl}-benzoic acid;
- 25 ggg) 3-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethylamino]-piperidin-1-yl}-phenyl)-propionic acid ethyl ester;
- hhh) 2-(4-{4-[2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethylamino]-piperidin-1-yl}-benzylidene)-malonic acid diethyl ester;
- iii) 2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethylamino]-piperidin-1-yl}-benzylidene)-malonic acid monoethyl ester;
- 30 jjj) 4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethylamino]-piperidin-1-yl}-benzamide;
- kkk) N-benzyloxy-4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzamide;
- 35 III) diethyl (2S)-2-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethylamino]-1-piperidinyl}benzoyl)amino]pentanedioate;

- mmm) ethyl 3-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}benzoyl)amino]propanoate;
- nnn) (2S)-2-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}benzoyl)amino]pentanedioic acid;
- 5 ooo) N-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}benzoyl)-beta-alanine;
- ppp) ethyl [(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}benzoyl)amino]acetate;
- qqq) [(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}benzoyl)amino]acetic acid;
- 10 rrr) (2S)-2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethyl)-amino]-piperidin-1-yl}-benzoylamino)-4-methyl-pentanoic acid ethyl ester;
- sss) (2S)-2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethyl)-amino]-piperidin-1-yl}-benzoylamino)-4-methyl-pentanoic acid;
- 15 ttt) 1-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoyl)-pyrrolidine-(2S)-2-carboxylic acid methyl ester;
- uuu) 1-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)-ethylamino]-piperidin-1-yl}-benzoyl)-pyrrolidine-(2S)-2-carboxylic acid;
- vvv) (2S)-2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethyl)-amino]-piperidin-1-yl}-benzoylamino)-3-methyl-butyric acid ethyl ester;
- 20 www) (2S)-2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethyl)-amino]-piperidin-1-yl}-benzoylamino)-3-methyl-butyric acid;
- xxx) (2S)-2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethyl)-amino]-piperidin-1-yl}-benzoylamino)-3-phenyl-propionic acid methyl ester;
- 25 yyy) (2S)-2-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethyl)-amino]-piperidin-1-yl}-benzoylamino)-3-phenyl-propionic acid;
- zzz) methyl 1-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-piperidinyl}benzoyl)amino]cyclopropanecarboxylate;
- aaaa) [butyl-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethyl)-amino]-piperidin-1-yl}-benzoyl)-amino]-acetic acid ethyl ester;
- 30 bbbb) methyl [(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}benzoyl)amino]acetate;
- cccc) (2S)-2-(4-{4-[2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethylamino]-piperidin-1-yl}-benzoylamino)-4-methyl-pentanoic acid methyl ester;
- 35 dddd) (2E)-3-(4-{4-[(2R)-2-hydroxy-2-(4-hydroxy-3-methanesulfonylamino-phenyl)ethyl)-amino]-piperidin-1-yl}-phenyl)-acrylic acid;

- eeee) 4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}-N-[(1S)-1-(hydroxymethyl)-3-methylbutyl]benzamide;
- ffff) 4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-sulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}-N-[(3S)-2-ethyl)amino]-1-piperidinyl}-N-[(3S)-2-oxoazepanyl]benzamide;
- 5 gggg) N-butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}-N-(1H-tetraazol-5-ylmethyl)benzamide;
- hhhh) N-{4-[4-(2-hydroxy-2-phenyl-ethylamino)-piperidin-1-yl]-phenyl}-4-methoxy-benzenesulfonamide;
- 10 iii) N-(4-{4-[2-hydroxy-2-(3-hydroxy-phenyl)ethylamino]piperidin-1-yl}phenyl)-4-methoxybenzenesulfonamide;
- jjjj) N-[4-(4-{4-[2-hydroxy-2-(3-hydroxy-phenyl)-ethylamino]-piperidin-1-yl}-phenyl-sulfamoyl)-phenyl]-acetamide;
- kkkk) N-(4-{4-[4-((2R)-2-hydroxy-2-phenyl-ethylamino)-piperidin-1-yl]-phenylsulfamoyl}-phenyl)-acetamide;
- 15 llll) N-(4-{4-[4-([2-hydroxy-2-(4-hydroxyphenyl)ethyl]amino)-1-piperidinyl]anilino]-sulfonyl}phenyl)acetamide;
- mmmm) N-[4-(4-[(2R)-2-(3-chlorophenyl)-2-hydroxyethyl]amino)-1-piperidinyl]phenyl]-4-methoxybenzenesulfonamide;
- 20 nnnn) N-[4-(4-[(2R)-2-hydroxy-2-phenylethyl]amino)-1-piperidinyl]phenyl]-4-methoxy-benzenesulfonamide;
- oooo) N-(4-{4-[4-([2-hydroxy-3-(4-methoxyphenoxy)propyl]amino)-1-piperidinyl]anilino]-sulfonyl}phenyl)acetamide;
- pppp) N-(4-{4-[4-[(2R)-2-(3,4-dihydroxyphenyl)-2-hydroxyethyl]amino)-1-piperidinyl]-anilino]sulfonyl}phenyl)acetamide;
- 25 qqqq) N-(4-{2-(4-([2-hydroxy-2-(3-hydroxyphenyl)ethyl]amino)-1-piperidinyl]anilino]-sulfonyl}phenyl)acetamide;
- rrrr) N-(4-{2-(4-[(2R)-2-(3,4-dihydroxyphenyl)-2-hydroxyethyl]amino)-1-piperidinyl]-anilino]sulfonyl}phenyl)acetamide;
- 30 ssss) N-[4-(4-[(2R)-2-(3,4-dihydroxyphenyl)-2-hydroxyethyl]amino)-1-piperidinyl]phenyl]-4-methoxybenzenesulfonamide;
- tttt) N-(4-{4-[4-([2-hydroxy-2-(4-hydroxy-3-methoxyphenyl)ethyl]amino)-1-piperidinyl]-anilino]sulfonyl}phenyl)acetamide;
- uuuu) N-(4-{4-[4-([2-(2,4-dihydroxyphenyl)-2-hydroxyethyl]amino)-1-piperidinyl]anilino]-sulfonyl}phenyl)acetamide;
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- vvvv) N-(4-{[4-(4-{[(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino}-1-piperidinyl)-anilino]sulfonyl}phenyl)acetamide;
- www) N-{4-[4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)sulfonyl}phenyl]acetamide;
- 5 xxxx) 4-{[(hexylamino)carbonyl]amino}-N-[4-(4-{[2-hydroxy-2-(6-methyl-3-pyridinyl)ethyl]-amino}-1-piperidinyl)phenyl]benzenesulfonamide;
- yyyy) N-(4-{[4-(4-{[(2S)-2-hydroxy-3-phenoxypropyl]amino}-1-piperidinyl)anilino]sulfonyl}phenyl)acetamide;
- zzzz) 5-[2-({[4-(4-{[(4-(acetylamino)phenyl]sulfonyl)amino]phenyl]-4-piperidinyl}amino)-1-hydroxyethyl]-1H-indole-7-carboxamide;
- 10 aaaaa) N-[4-({[4-(4-{[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino}-1-piperidinyl]anilino)sulfonyl}phenyl)acetamide;
- bbbb) 4-{[(hexylamino)carbonyl]amino}-N-{4-[4-({[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]phenyl}benzenesulfonamide;
- 15 ccccc) 4-{[(hexylamino)carbonyl]amino}-N-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl)benzenesulfonamide;
- dddd) 4-[4-(3-cyclopentylpropyl)-5-oxo-4,5-dihydro-1H-tetraazol-1-yl]-N-{4-[4-({[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]phenyl}benzenesulfonamide;
- 20 eeeee) N-{4-[4-({[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]phenyl}-5-(2-pyridinyl)-2-thiophenesulfonamide;
- ffff) N-[4-(4-{[(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino}-1-piperidinyl)phenyl]-3,4-dimethoxybenzenesulfonamide;
- 25 ggggg) N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl)-3,4-dimethoxybenzenesulfonamide;
- hhhhh) 4-butoxy-N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}phenyl)benzenesulfonamide;
- iiii) N-(4-{[4-(4-{[(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino}-1-piperidinyl)-anilino]sulfonyl}phenyl)acetamide;
- 30 jjjjj) 5-chloro-N-{4-[4-({[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]phenyl}-3-methyl-1-benzothiophene-2-sulfonamide;
- kkkkk) 4-cyano-N-{4-[4-({[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]phenyl}benzenesulfonamide;
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- IIII) 4-cyano-N-[(4-cyanophenyl)sulfonyl]-N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}benzenesulfonamide;
- 5 mmmmm) 3-bromo-5-chloro-N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}-2-thiophenesulfonamide;
- nnnnn) N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}-5-(3-isoxazolyl)-2-thiophenesulfonamide;
- ooooo) 4-[4-(3-cyclopentylpropyl)-5-oxo-4,5-dihydro-1H-tetraazol-1-yl]-N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl]amino}-1-piperidinyl)-phenyl}benzenesulfonamide;
- 10 ppppp) 4-butoxy-N-[4-(4-{[(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino}-1-piperidinyl)phenyl]benzenesulfonamide;
- qqqqq) N-[4-(4-{[3-(9H-carbazol-4-yloxy)-(2S)-2-hydroxypropyl]amino}-1-piperidinyl)-phenyl]-4-{[(hexylamino)carbonyl]amino}benzenesulfonamide;
- 15 rrrrr) N-{4-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl]amino}-1-piperidinyl)anilino)sulfonyl]phenyl}acetamide;
- sssss) N-[4-(4-{[(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino}-1-piperidinyl)-phenyl]-3,4-dimethoxybenzenesulfonamide;
- ttttt) N-[4-(4-{[(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino}-1-piperidinyl)phenyl]-5-(2-pyridinyl)-2-thiophenesulfonamide;
- 20 uuuuu) N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl]amino}-1-piperidinyl)phenyl)-5-(2-pyridinyl)-2-thiophenesulfonamide;
- vvvvv) N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl]amino}-1-piperidinyl)phenyl)-1-butanesulfonamide;
- 25 wwwww) N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}-1-butanesulfonamide;
- xxxxx) N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl]amino}-1-piperidinyl)phenyl)-1-octanesulfonamide;
- yyyyy) N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}-1-octanesulfonamide;
- 30 zzzzz) N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}-5-{[5-(trifluoromethyl)-2-pyridinyl]sulfonyl}-2-thiophenesulfonamide;
- aaaaa) N-[4-(4-{[(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino}-1-piperidinyl)-phenyl]-5-{[5-(trifluoromethyl)-2-pyridinyl]sulfonyl}-2-thiophenesulfonamide;
- 35

- bbbbb) 4-[(2,4-dioxo-1,3-thiazolidin-5-yl)methyl]-N-{4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}benzenesulfonamide;
- 5 ccccc) 4-[(2,4-dioxo-1,3-thiazolidin-5-yl)methyl]-N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl]amino]-1-piperidinyl}phenyl)benzenesulfonamide;
- ddddd) N-{4-[4-((2S)-2-hydroxy-3-[(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-5-quinolinyl)-oxy]propyl)amino)-1-piperidinyl]phenyl}-3,4-dimethoxybenzenesulfonamide;
- 10 eeeee) N-[4-(4-[(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-piperidinyl]phenyl]-1-octanesulfonamide;
- ffffff) 4-[(hexylamino)carbonyl]amino}-N-{4-[4-((2S)-2-hydroxy-3-[(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-5-quinolinyl)oxy]propyl)amino)-1-piperidinyl]phenyl}benzenesulfonamide;
- ggggg) N-{4-[4-((2S)-2-hydroxy-3-[(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-5-quinolinyl)-oxy]propyl)amino)-1-piperidinyl]phenyl}-1-butanefulfonamide;
- 15 hhhhh) N-[4-(4-[4-((2S)-2-hydroxy-3-[(8-hydroxy-2-oxo-1,2,3,4-tetrahydro-5-quinolinyl)-oxy]propyl)amino)-1-piperidinyl]anilino)sulfonyl]phenyl]acetamide;
- iiiiii) N-(4-{4-[(2S)-2-hydroxy-3-(4-hydroxy-3-[(methylsulfonyl)amino]phenoxy)-propyl]amino)-1-piperidinyl}phenyl)-4-dimethoxybenzenesulfonamide;
- 20 jjjjj) N-(4-{4-[(2S)-2-hydroxy-3-(4-hydroxy-3-[(methylsulfonyl)amino]phenoxy)-propyl]amino)-1-piperidinyl}phenyl)-1-butanefulfonamide;
- kkkkkk) 4-[(hexylamino)carbonyl]amino}-N-(4-{4-[(2S)-2-hydroxy-3-{4-hydroxy-3-[(methylsulfonyl)amino]phenoxy}propyl]amino)-1-piperidinyl}phenyl)benzenesulfonamide;
- 25 lllll) N-[4-(4-[(2R)-2-(3-chlorophenyl)-2-hydroxyethyl]amino)-1-piperidinyl]phenyl]-4-[(hexylamino)carbonyl]amino}benzenesulfonamide;
- mmmmm) ethyl {4-[4-(4-[(2S)-2-hydroxy-3-{4-hydroxy-3-[(methylsulfonyl)amino]phenoxy)-propyl]amino)-1-piperidinyl]anilino)sulfonyl]phenyl}acetate;
- nnnnn) methyl {4-[4-(4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)-ethyl]amino)-1-piperidinyl]anilino)sulfonyl]phenoxy}acetate;
- 30 ooooo) methyl [4-(4-[4-((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)-oxy]propyl)amino)-1-piperidinyl]anilino)sulfonyl]phenoxy}acetate;
- ppppp) N-[5-((2S)-3-[(1-{4-[(butylsulfonyl)amino]phenyl}-4-piperidinyl)amino]-2-hydroxypropyl)oxy)-2-hydroxyphenyl]benzenesulfonamide;
- 35 qqqqq) N-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(isopropylsulfonyl)amino]phenyl}ethyl)-amino)-1-piperidinyl}phenyl)-1-butanefulfonamide;

	rrrrrr)	4-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}anilino)sulfonyl]benzoic acid;
	ssssss)	ethyl 4-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}anilino)sulfonyl]benzoate;
5	tttttt)	methyl {4-[(4-{4-[(2R)-2-{4-chloro-3-[(methylsulfonyl)amino]phenyl}-2-hydroxy-ethyl)amino]-1-piperidinyl}anilino)sulfonyl]phenoxy}acetate;
	uuuuuu)	methyl 3-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}anilino)sulfonyl]-2-thiophenecarboxylate;
10	vvvvvv)	3-[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}anilino)sulfonyl]-2-thiophenecarboxylic acid;
	wwwwww)	benzyl [(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}anilino)sulfonyl]acetate;
	xxxxxx)	[(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}anilino)sulfonyl]acetic acid;
15	yyyyyy)	benzyl [(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)sulfonyl]acetate;
	zzzzzz)	[(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}-ethyl)amino]-1-piperidinyl}anilino)sulfonyl]acetic acid;
	aaaaaaa)	N-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}phenyl)-3-pyridinesulfonamide;
20	bbbbbbb)	3,4-dichloro-N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino]-1-piperidinyl}phenyl}benzenesulfonamide;
	ccccccc)	N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl]amino]-1-piperidinyl}phenyl}-4-(trifluoromethyl)benzenesulfonamide;
25	ddddddd)	N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl]amino]-1-piperidinyl}phenyl}-4-(trifluoromethoxy)benzenesulfonamide;
	eeeeeee)	N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl]amino]-1-piperidinyl}phenyl}-4-methoxybenzenesulfonamide;
30	ffffff)	4-chloro-N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)-oxy]propyl]amino]-1-piperidinyl}phenyl}benzenesulfonamide;
	ggggggg)	4-butyl-N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)-oxy]propyl]amino]-1-piperidinyl}phenyl}benzenesulfonamide;
	hhhhhhh)	3,5-dichloro-N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino]-1-piperidinyl}phenyl}benzenesulfonamide;
35	iiiiiii)	N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl]amino]-1-piperidinyl}phenyl}-2,5-dimethoxybenzenesulfonamide;

	jjjjjjj)	N-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)-amino]-1-piperidinyl}phenyl)-2,5-dimethoxybenzenesulfonamide;
	kkkkkkkk)	ethyl {[4-butylphenyl)sulfonyl]-4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]anilino}acetate;
5	lllllll)	5-bromo-N-[(5-bromo-2-methoxyphenyl)sulfonyl]-N-[4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]-phenyl]-2-methoxybenzenesulfonamide;
	mmmmmmm)	5-bromo-N-[4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]phenyl]-2-methoxybenzenesulfonamide;
10	nnnnnnnn)	ethyl [(3,4-dimethoxyphenyl)sulfonyl]-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino}acetate;
	oooooooo)	ethyl 5-[(2S)-3-{1-(4-[(3,4-dimethoxyphenyl)sulfonyl]amino)phenyl)-4-piperidinyl]amino}-2-hydroxypropyl]oxy]-2-methyl-1H-indole-3-carboxylate;
	pppppppp)	ethyl 4-[(2S)-3-{1-(4-[(3,4-dimethoxyphenyl)sulfonyl]amino)phenyl)-4-piperidinyl]amino}-2-hydroxypropyl]oxy]-2-methyl-5-phenyl-1H-pyrrole-3-carboxylate;
15	qqqqqqqq)	benzyl ((butylsulfonyl)-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)acetate;
	rrrrrrrr)	((butylsulfonyl)-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)acetic acid;
20	ssssssss)	[(3,4-dimethoxyphenyl)sulfonyl]-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)acetic acid;
	ttttttt)	ethyl ((butylsulfonyl)-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl}ethyl)amino]-1-piperidinyl}anilino)acetate;
25	uuuuuuuu)	4-[(3-chloro-5-(trifluoromethyl)-2-pyridinyl]oxy)-N-[4-(4-[(2S)-2-hydroxy-3-phenoxypropyl]amino)-1-piperidinyl]phenyl]benzenesulfonamide;
	vvvvvvv)	N-[(5-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]anilino}sulfonyl)-2-thienyl]methyl]benzamide;
	wwwwwww)	N-[(5-{4-[4-[(2S)-2-hydroxy-3-phenoxypropyl]amino)-1-piperidinyl]anilino}-sulfonyl)-2-thienyl]methyl]benzamide;
30	xxxxxxx)	N-[(5-{4-[4-[(2-hydroxy-2-(3-hydroxyphenyl)ethyl]amino)-1-piperidinyl]anilino}-sulfonyl)-2-thienyl]methyl]benzamide;
	yyyyyyy)	4-[(3-chloro-5-(trifluoromethyl)-2-pyridinyl]oxy)-N-[4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino)-1-piperidinyl]phenyl]-benzenesulfonamide;
35		

	zzzzzzzz)	4-[[3-chloro-5-(trifluoromethyl)-2-pyridinyl]oxy]-N-[4-(4-{[2-hydroxy-2-(3-hydroxyphenyl)ethyl]amino}-1-piperidinyl)phenyl]benzenesulfonamide;
	aaaaaaaa)	3,5-dichloro-4-(2-chloro-4-nitrophenoxy)-N-{4-[4-(((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl]-benzenesulfonamide;
5	bbbbbbbbb)	3,5-dichloro-4-(2-chloro-4-nitrophenoxy)-N-[4-(4-(((2S)-2-hydroxy-3-phenoxypropyl)amino)-1-piperidinyl)phenyl]benzenesulfonamide;
	cccccccc)	3,5-dichloro-4-(2-chloro-4-nitrophenoxy)-N-[4-(4-{[2-hydroxy-2-(3-hydroxyphenyl)ethyl]amino}-1-piperidinyl)phenyl]benzenesulfonamide;
10	dddddddd)	N-[4-(4-(((2S)-2-hydroxy-3-phenoxypropyl)amino)-1-piperidinyl)phenyl]-2-thiophenesulfonamide;
	eeeeeeee)	4-butoxy-N-[4-(4-(((2S)-2-hydroxy-3-phenoxypropyl)amino)-1-piperidinyl)phenyl]benzenesulfonamide;
	ffffffff)	N-[4-(4-(((2S)-2-hydroxy-2-(3-hydroxyphenyl)ethyl]amino)-1-piperidinyl)phenyl]-2-thiophenesulfonamide;
15	ggggggggg)	4-butoxy-N-{4-[4-(((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl]benzenesulfonamide;
	hhhhhhhhh)	N-{4-[4-(((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}-3,4-dimethoxybenzenesulfonamide;
20	iiiiiii)	N-[4-(4-(((2S)-2-hydroxy-3-phenoxypropyl)amino)-1-piperidinyl)phenyl]-3,4-dimethoxybenzenesulfonamide;
	jjjjjjjjj)	N-[4-(4-{[2-hydroxy-2-(3-hydroxyphenyl)ethyl]amino}-1-piperidinyl)phenyl]-3,4-dimethoxybenzenesulfonamide;
	kkkkkkkkk)	N-{4-[4-(((2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl)amino)-1-piperidinyl]phenyl}-2-thiophenesulfonamide;
25	lllllllll)	ethyl 3-(4-{4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino}-1-piperidinyl)anilino)-3-oxopropanoate;
	mmmmmmmmm)	3-(4-{4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino}-1-piperidinyl)anilino)-3-oxopropanoic acid;
30	nnnnnnnnn)	ethyl 3-(butyl-4-{4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino}-1-piperidinyl)anilino)-3-oxopropanoate;
	ooooooooo)	3-(butyl-4-{4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino}-1-piperidinyl)anilino)-3-oxopropanoic acid;
	ppppppppp)	ethyl 3-(cyclohexyl-4-{4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino}-1-piperidinyl)anilino)-3-oxopropanoate;
35	qqqqqqqqq)	3-(cyclohexyl-4-{4-(((2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]

		phenyl)ethyl)amino]-1-piperidinyl]anilino)-3-oxopropanoic acid;
	rrrrrrrr)	ethyl {[4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)-ethyl)amino]-1-piperidinyl]anilino)carbonyl]amino}acetate;
5	ssssssss)	{[4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)-amino]-1-piperidinyl]anilino)carbonyl]amino}acetic acid;
	tttttttt)	ethyl {[4-(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)amino]-1-piperidinyl]anilino)carbonyl]amino}acetate;
	uuuuuuuu)	{[4-(butyl-4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)-ethyl)amino]-1-piperidinyl]anilino)carbonyl]amino}acetic acid;
10	vvvvvvvv)	N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl]amino]-1-piperidinyl]phenyl}-3,4-dimethoxybenzamide;
	wwwwwwww)	2-chloro-N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino]-1-piperidinyl]phenyl}acetamide;
	xxxxxxx)	N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl]amino]-1-piperidinyl]phenyl}-2-(4-morpholinyl)acetamide;
15	yyyyyyyy)	2-(dimethylamino)-N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino]-1-piperidinyl]phenyl}acetamide;
	zzzzzzzz)	N-(4-{4-[(2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)ethyl)-amino]-1-piperidinyl]phenyl}-3,4-dimethoxybenzamide;
20	aaaaaaaa)	N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl]amino]-1-piperidinyl]phenyl}butanamide;
	bbbbbbbbb)	N-[4-(4-{[(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino}-1-piperidinyl)-phenyl]butanamide;
	cccccccc)	N-[4-(4-{[(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino}-1-piperidinyl)-phenyl]-3,4-dimethoxybenzamide;
25	dddddddd)	N-[4-(4-{[(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino}-1-piperidinyl)-phenyl]-3,4-dimethoxybenzamide;
	eeeeeeee)	N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]-propyl]amino]-1-piperidinyl]phenyl}-1,3-benzodioxole-5-carboxamide;
30	fffffff)	N-[4-(4-{[(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino}-1-piperidinyl)-phenyl]-1,3-benzodioxole-5-carboxamide;
	gggggggg)	3-cyclopentyl-N-{4-[4-[(2S)-2-hydroxy-3-[(2-oxo-2,3-dihydro-1H-benzimidazol-4-yl)oxy]propyl]amino]-1-piperidinyl]phenyl}propanamide;
	hhhhhhhh)	3-cyclopentyl-N-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)-amino]phenyl)ethyl)amino]-1-piperidinyl]phenyl)propanamide;
35	iiiiiiii)	N-(4-{4-[(2R)-2-hydroxy-2-{4-hydroxy-3-[(methylsulfonyl)amino]phenyl)-

ethyl)amino]-1-piperidinyl}phenyl)-1,3-benzodioxole-5-carboxamide;
 j) N-acetyl-N-[4-(3-([(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-azetidiny]phenyl]acetamide;
 k) 4-butoxy-N-[4-(3-([(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-azetidiny]phenyl]benzenesulfonamide;
 l) N-[4-(3-([(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-azetidiny]phenyl)-3,4-dimethoxybenzenesulfonamide;
 m) N-(4-([4-(3-([(2S)-2-hydroxy-3-(4-hydroxyphenoxy)propyl]amino)-1-azetidiny]anilino)sulfonyl}phenyl)acetamide;
 n) 4-butoxy-N-[4-(3-([(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino)-1-azetidiny]phenyl]benzenesulfonamide;
 o) N-[4-(3-([(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino)-1-azetidiny]phenyl]acetamide;
 p) N-[4-(3-([(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino)-1-azetidiny]phenyl)-3,4-dimethoxybenzenesulfonamide; or
 q) N-(4-([4-(3-([(2S)-3-(9H-carbazol-4-yloxy)-2-hydroxypropyl]amino)-1-azetidiny]anilino)sulfonyl}phenyl)acetamide;

or a pharmaceutically acceptable salt thereof.

18. A method of treating metabolic disorders mediated by insulin resistance or hyperglycemia in a mammal in need thereof which comprises providing to said mammal, an effective amount of a compound of formula I as claimed in any one of Claims 1 to 17.

19. A method of treating or inhibiting type II diabetes in a mammal in need thereof which comprises providing to said mammal, an effective amount of a compound of Formula I as claimed in any one of Claims 1 to 17.

20. A method of modulating glucose levels in a mammal in need thereof which comprises providing to said mammal, an effective amount of a compound of formula I as claimed in any one of Claims 1 to 17.

21. A method of treating or inhibiting urinary incontinence in a mammal in need thereof which comprises providing to said mammal an effective amount of a compound of formula I as claimed in any one of Claims 1 to 17.

22. A method of treating or inhibiting atherosclerosis, gastrointestinal disorders, neurogenetic inflammation, glaucoma, or ocular hypertension in a mammal in need thereof, which comprises providing to said mammal an effective amount of a compound of formula I as claimed in any one of Claims 1 to 17.

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23. A method of increasing the lean meat to fat ratio in a mammal in need thereof, which comprises providing to said mammal an effective amount of a compound of formula I as claimed in any one of Claims 1 to 17.

10 24. Use of a compound of formula I as claimed in any one of Claims 1 to 17 or a pharmaceutically acceptable salt thereof in the preparation of a medicament for treating metabolic disorders mediated by insulin resistance or hyperglycemia in a mammal.

15 25. Use of a compound of formula I as claimed in any one of Claims 1 to 17 or a pharmaceutically acceptable salt thereof in the preparation of a medicament for treating or inhibiting type II diabetes in a mammal.

20 26. Use of a compound of formula I as claimed in any one of Claims 1 to 17 or a pharmaceutically acceptable salt thereof in the preparation of a medicament for modulating glucose levels in a mammal.

25 27. Use of a compound of formula I as claimed in any one of Claims 1 to 17 or a pharmaceutically acceptable salt thereof in the preparation of a medicament for treating or inhibiting urinary incontinence in a mammal.

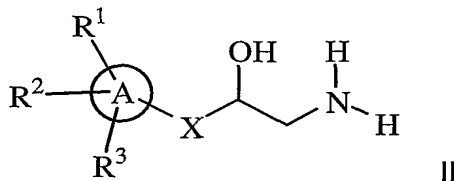
30 28. Use of a compound of formula I as claimed in any one of Claims 1 to 17 or a pharmaceutically acceptable salt thereof in the preparation of a medicament for treating or inhibiting atherosclerosis, gastrointestinal disorders, neurogenetic inflammation, glaucoma, or ocular hypertension in a mammal.

35 29. Use of a compound of formula I as claimed in any one of Claims 1 to 17 or a pharmaceutically acceptable salt thereof in the preparation of a medicament for increasing the lean meat to fat ratio in a mammal.

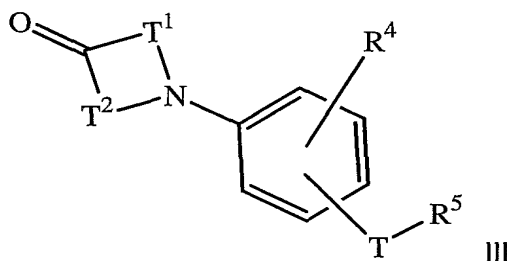
30 30. A pharmaceutical composition which comprises a compound of formula I as claimed in any one of Claims 1 to 17 and a pharmaceutical carrier.

31. A process for preparing a compound of formula I as claimed in Claim 1 which comprises one of the following:

a) reductively aminating a compound of formula II



wherein R_1 , R_2 , R_3 , X and A are as defined in Claim 1; with a compound of formula III



wherein T, T^1 , T^2 , R^4 and R^5 are as defined in Claim 1 to give a compound of formula I;

or

10 b) removing any protecting groups from a compound of formula I in which at least one substituent carries a protecting group to give a compound of formula ;

or

c) converting a basic compound of formula I to a salt thereof by reaction with a pharmaceutically acceptable acid;

15 or

d) converting a compound of formula I having one or more reactive substituent groups to a different compound of formula I;

or

e) isolating an isomer of a compound of formula I from a mixture thereof.

INTERNATIONAL SEARCH REPORT

Int'l Application No

PCT/US 01/22387

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C07D211/58 C07D401/10 C07D417/10 C07D417/14 C07D401/14
 C07D401/12 C07D409/14 C07D413/14 C07D409/12 C07D405/14
 C07D405/12 C07D223/12 C07D403/12 //(C07D401/10,233:00,

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C07D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, BIOSIS, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	WO 01 17989 A (SANOFI SYNTHELABO ;CECCHI ROBERTO (IT); OLIVA AMBROGIO (IT)) 15 March 2001 (2001-03-15) examples 4,5	1,2,4-6, 10, 14-17, 24-30
X,P	WO 01 43744 A (SANOFI SYNTHELABO ;CECCHI ROBERTO (IT)) 21 June 2001 (2001-06-21) examples 2-9,11,12,17-19	1,2,4-6, 10, 13-17, 24-30
Y	WO 99 65895 A (MARSAULT ERIC ;SANOFI SYNTHELABO (FR); CROCI TIZIANO (IT); GUZZI U) 23 December 1999 (1999-12-23) the whole document -/--	1-30

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
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- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

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Date of the actual completion of the international search

9 November 2001

Date of mailing of the international search report

16/11/2001

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Frelon, D

INTERNATIONAL SEARCH REPORT

Intel Application No
PCT/US 01/22387

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 211:00), (C07D417/10, 277:00, 211:00)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 940 387 A (TOKYO TANABE CO) 8 September 1999 (1999-09-08) the whole document & WO 97 15549 A 1 May 1997 (1997-05-01) cited in the application -----	1-30
Y	WO 98 09625 A (MUEHL BRIAN S ; JONES CHARLES D (US); LILLY CO ELI (US); THORPE AND) 12 March 1998 (1998-03-12) abstract; claim 31; example 26 & EP 0 764 640 A 26 March 1997 (1997-03-26) cited in the application -----	1-30

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

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INTERNATIONAL SEARCH REPORT

Inte al Application No

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